Temperature Versus Resistance

°C	°F	OHMS
Temperature vs Resistance Values (Approximate)		
150	302	47
140	284	60
130	266	77
120	248	100
110	230	132
100	212	177
90	194	241
80	176	332
70	158	467
60	140	667
50	122	973
45	113	1188
40	104	1459
35	95	1802
30	86	2238
25	77	2796
20	68	3520
15	59	4450
10	50	5670
5	41	7280
0	32	9420
-5	23	12300
-10	14	16180
-15	5	21450
-20	-4	28680
-30	-22	52700
-40	-40	100700

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Altitude Versus Barometric Pressure

Altitude Measured in Meters (m)	Altitude Measured in Feet (ft)	Barometric Pressure Measured in Kilopascals (kPa)
Determine your altitude by contacting a local weather station or by using another reference source.		
4 267	14,000	56-64
3 962	13,000	58-66
3 658	12,000	61-69
3 353	11,000	64-72
3 048	10,000	66-74
2 743	9,000	69-77
2 438	8,000	71-79
2 134	7,000	74-82
1 829	6,000	77-85
1 524	5,000	80-88
1 219	4,000	83-91
914	3,000	87-95
610	2,000	90-98
305	1,000	94-102
0	0 Sea Level	96-104
-305	-1,000	101-105

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Ignition System Specifications

Application	Specification	
	Metric	English
Firing Order	1-8-7-2-6-5-4-3	
Spark Plug Wire Resistance	188-312 ohms	
Spark Plug Torque	15 N·m	11 lb ft
Spark Plug Gap	1.02 mm	0.040 in
Spark Plug Type	Platinum	

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Fastener Tightening Specifications

Application	Specifications	
	Metric	English
Accelerator Pedal Position (APP) Sensor Assembly Retaining Bolts	20 N·m	15 lb ft
Air Cleaner Intake Duct to Throttle Body Retaining Clamp	4 N·m	35 lb in
Air Cleaner Lower Housing Retaining Bolts	10 N·m	89 lb in
Camshaft Position (CMP) Sensor Retaining Bolt	25 N·m	18 lb ft
Crankshaft Position (CKP) Sensor Retaining Bolt	25 N·m	18 lb ft
Engine Coolant Temperature (ECT) Sensor	20 N·m	15 lb ft
Evaporative Emissions (EVAP) Canister Retaining Bolts	6 N·m	53 lb in
Fuel Filler Hose Clamps	4 N·m	35 lb in
Fuel Filler Pipe to Chassis Retaining Bolts	9 N·m	80 lb in
Fuel Pipe Stone Guard Retaining Nuts	5 N·m	44 lb in
Fuel Rail Ground Strap To Intake Manifold Retaining Bolts	10 N·m	89 lb in
Fuel Rail Retaining Bolts	10 N·m	89 lb in
Fuel Tank Strap Upper Retaining Bolts	20 N·m	15 lb ft
Heated Oxygen Sensor (HO2S)	42 N·m	31 lb ft
Ignition Coil to Ignition Plate Assembly Retaining Bolts	12 N·m	106 lb in
Ignition Coil To Rocker Cover Retaining Blots	12 N·m	106 lb in
Intake Air Temperature/Mass Air Flow (AT/ MAF) to Air Intake Duct Retaining Clamp	2 N·m	18 lb in
Intake Air Temperature/Mass Air Flow (AT/ MAF) to Upper Air Cleaner Body Retaining Clamp	2 N·m	18 lb in
Knock Sensor (KS) Retaining Bolt	20 N·m	15 lb ft
Rear Subframe to Chassis Retaining Bolts		
- First pass	65 N·m	48 lb ft
- Final pass	125 Degrees	
Spark Plugs		
- Fit New Spark Plug	20 N·m	15 lb ft
- Refit Existing Spark Plug	15 N·m	11 lb ft
Throttle Body Retaining Bolts	12 N·m	106 lb in

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Engine Control Module Replacement

Note: In order to prevent internal ECM damage, the ignition must be OFF when you disconnect or reconnect the power to the ECM. For example, disconnect the power when you work with the following components:

- A battery cable
- The ECM pigtail
- The ECM fuse
- Jumper cables

Note: When you diagnose or replace the ECM, remove any debris from the ECM connector surfaces before servicing the ECM module connector gaskets. Make sure that the gaskets are installed correctly. The gaskets prevent contamination intrusion into the ECM.

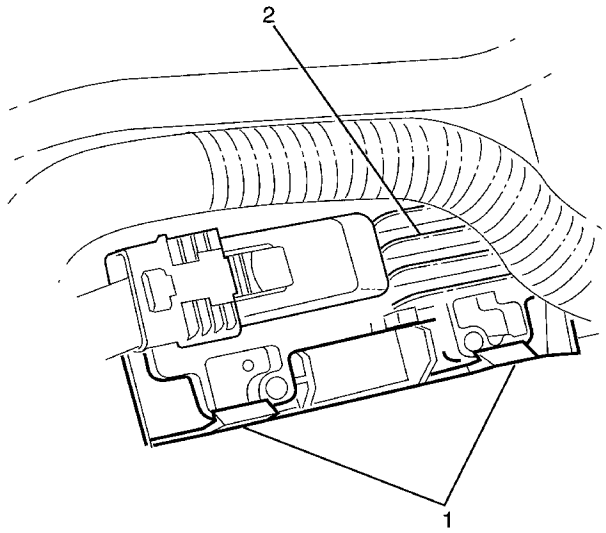
Note: The replacement ECM MUST be programmed.

Engine control module (ECM) service should normally consist of either ECM replacement or electrically erasable programmable read only memory (EEPROM) programming. If the diagnostic procedures require ECM replacement, inspect the ECM first to see if the correct part is being used.

Removal Procedure

Note: It is necessary to record the remaining engine oil life. If the replacement module is not programmed with the remaining engine oil life, the engine oil life will default to 100 percent. If the replacement module is not programmed with the remaining engine oil life, the engine oil will need to be changed at 5000 km (3,000 mi) from the last engine oil change.

1. Using a scan tool, retrieve the percentage of remaining engine oil. Record the remaining engine oil life.
2. Disconnect the negative battery cable. Refer to Battery Negative Cable Disconnection and Connection.



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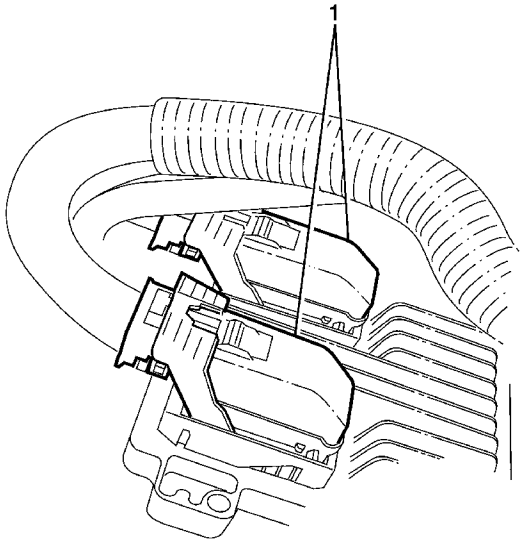
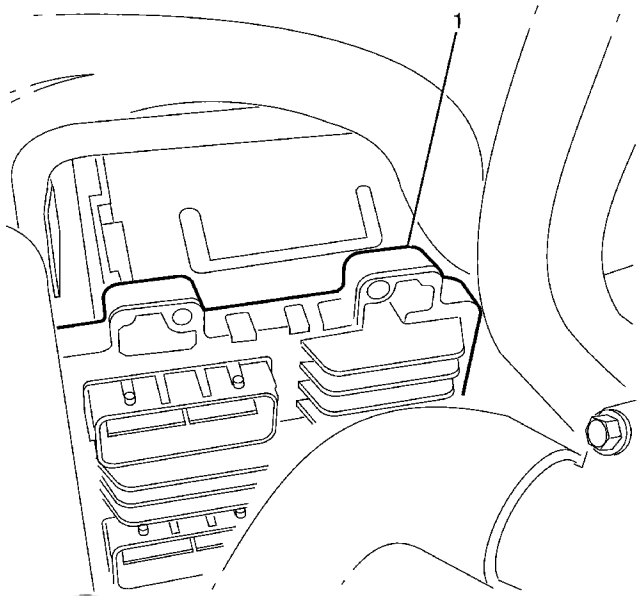
3. Release the ECM retaining clips (1) and detach the ECM (2).



4. Move the connector lock levers to the unlock position and disconnect the ECM electrical connectors (1).

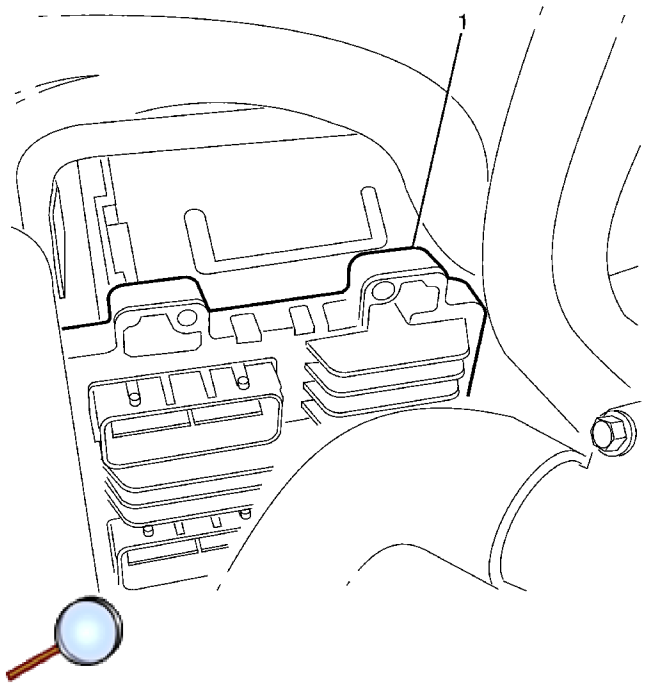


5. Remove the ECM from the vehicle.

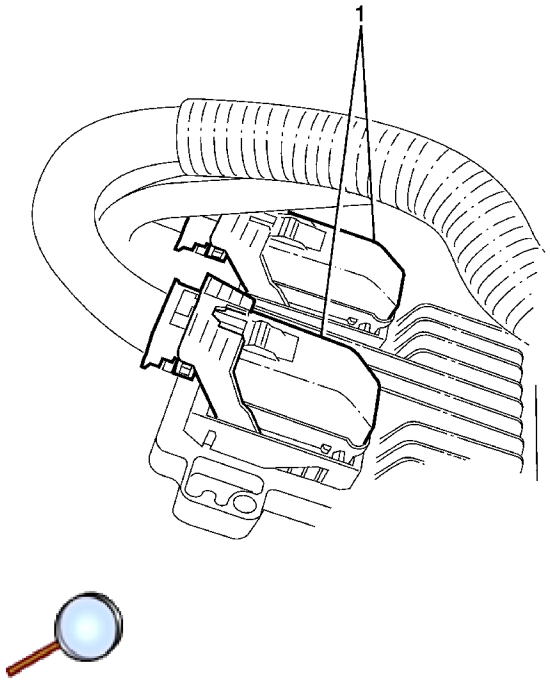
Installation Procedure

Caution: Do not touch the connector pins or soldered components on the circuit board in order to prevent possible electrostatic discharge (ESD) damage to the PCM.

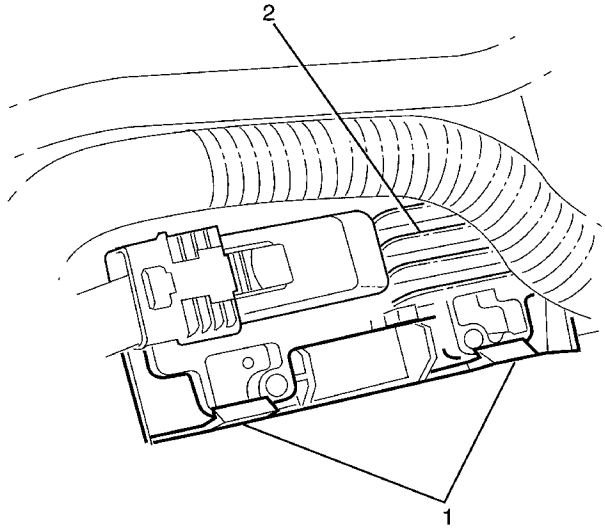
Caution: In order to prevent internal damage to the PCM, the ignition must be OFF when disconnecting or reconnecting the PCM connector.



1. Install the ECM to the vehicle.



2. Connect the ECM electrical connectors (1).



3. Engage the ECM retaining clips (1) to secure the ECM (2).
4. Connect the negative battery cable. Refer to Battery Negative Cable Disconnection and Connection.
5. If a new ECM is being installed, program the ECM. Refer to Service Programming System (SPS).

Crankshaft Position System Variation Learn

1. Install a scan tool.
2. Monitor the engine control module (ECM) for DTCs with a scan tool. If other DTCs are set, except DTC P0315, refer to Diagnostic Trouble Code (DTC) List - Vehicle for the applicable DTC that set.
3. Select the crankshaft position (CKP) variation learn procedure with a scan tool.
4. The scan tool instructs you to perform the following:
   4.1. Accelerate to wide open throttle (WOT).
   4.2. Release throttle when fuel cut-off occurs.
   4.3. Observe fuel cut-off for applicable engine.
   4.4. Engine should not accelerate beyond calibrated RPM value.
   4.5. Release throttle immediately if value is exceeded.
   4.6. Block drive wheels.
   4.7. Set parking brake.
   4.8. DO NOT apply brake pedal.
   4.9. Cycle ignition from OFF to ON.
   4.10. Apply and hold brake pedal.
   4.11. Start and idle engine.
   4.12. Turn A/C OFF.
   4.13. Vehicle must remain in Park or Neutral.
   4.14. The scan tool monitors certain component signals to determine if all the conditions are met to continue with the procedure. The scan tool only displays the condition that inhibits the procedure. The scan tool monitors the following components:
   - CKP sensors activity--If there is a CKP sensor condition, refer to the applicable DTC that set.
   - Camshaft position (CMP) sensor activity--If there is a CMP sensor condition, refer to the applicable DTC that set.
   - Engine coolant temperature (ECT)--If the ECT is not warm enough, idle the engine until the engine coolant temperature reaches the correct temperature.
5. Enable the CKP System Variation Learn Procedure with a scan tool.

Important: While the learn procedure is in progress, release the throttle immediately when the engine starts to decelerate. The engine control is returned to the operator and the engine responds to throttle position after the learn procedure is complete.

6. Accelerate to WOT.
7. Release when the fuel cut-off occurs.
8. Test in progress.
9. The scan tool displays Learn Status: Learned this ignition. If the scan tool indicates that DTC P0315 ran and passed, the CKP Variation Learn Procedure is complete. If the scan tool indicates DTC P0315 failed or did not run, refer to DTC P0315. If any other DTCs set, refer to Diagnostic Trouble Code (DTC) List - Vehicle for the applicable DTC that set.
10. Turn OFF the ignition for 30 seconds after the learn procedure is completed successfully.
11. The CKP Variation Learn Procedure is also required when the following service procedures have been performed, regardless of whether DTC P0315 is set:

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- A CKP sensor replacement
- An engine replacement
- A ECM replacement
- A harmonic balancer replacement
- A crankshaft replacement
- Any engine repairs which disturb the CKP sensor relationship

Engine Control Module Replacement

Note: In order to prevent internal ECM damage, the ignition must be OFF when you disconnect or reconnect the power to the ECM. For example, disconnect the power when you work with the following components:

- A battery cable
- The ECM pigtail
- The ECM fuse
- Jumper cables

Note: When you diagnose or replace the ECM, remove any debris from the ECM connector surfaces before servicing the ECM module connector gaskets. Make sure that the gaskets are installed correctly. The gaskets prevent contamination intrusion into the ECM.

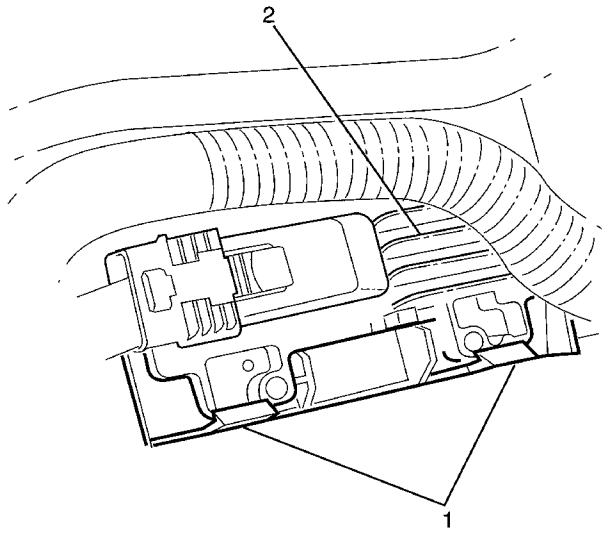
Note: The replacement ECM MUST be programmed.

Engine control module (ECM) service should normally consist of either ECM replacement or electrically erasable programmable read only memory (EEPROM) programming. If the diagnostic procedures require ECM replacement, inspect the ECM first to see if the correct part is being used.

Removal Procedure

Note: It is necessary to record the remaining engine oil life. If the replacement module is not programmed with the remaining engine oil life, the engine oil life will default to 100 percent. If the replacement module is not programmed with the remaining engine oil life, the engine oil will need to be changed at 5000 km (3,000 mi) from the last engine oil change.

1. Using a scan tool, retrieve the percentage of remaining engine oil. Record the remaining engine oil life.
2. Disconnect the negative battery cable. Refer to Battery Negative Cable Disconnection and Connection.



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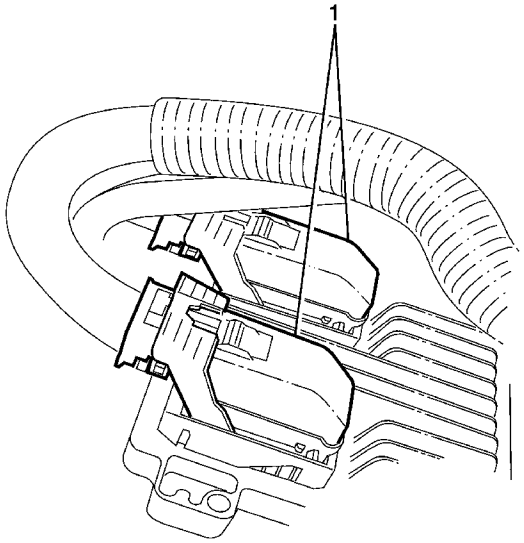
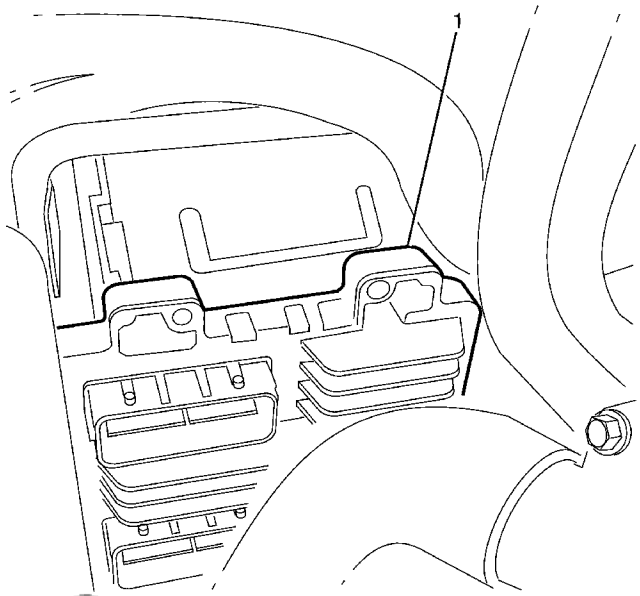
3. Release the ECM retaining clips (1) and detach the ECM (2).



4. Move the connector lock levers to the unlock position and disconnect the ECM electrical connectors (1).

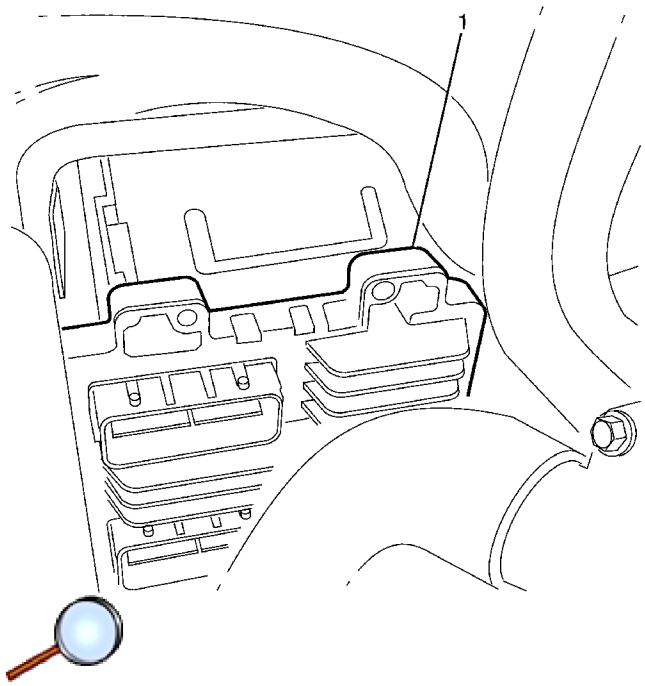


5. Remove the ECM from the vehicle.

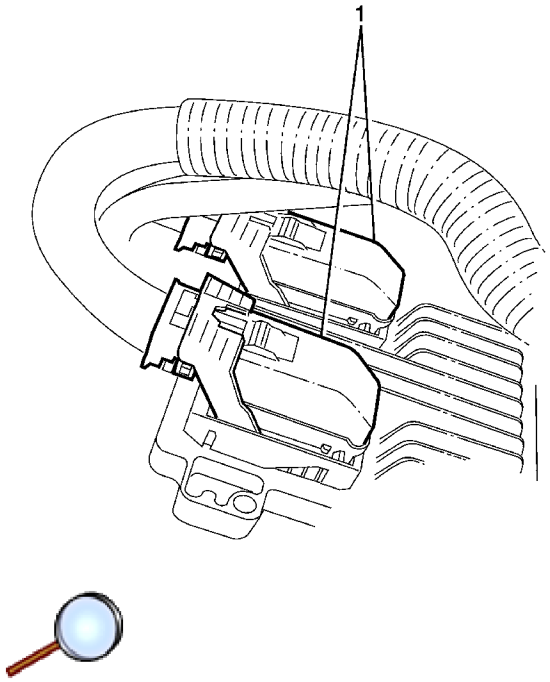
Installation Procedure

Caution: Do not touch the connector pins or soldered components on the circuit board in order to prevent possible electrostatic discharge (ESD) damage to the PCM.

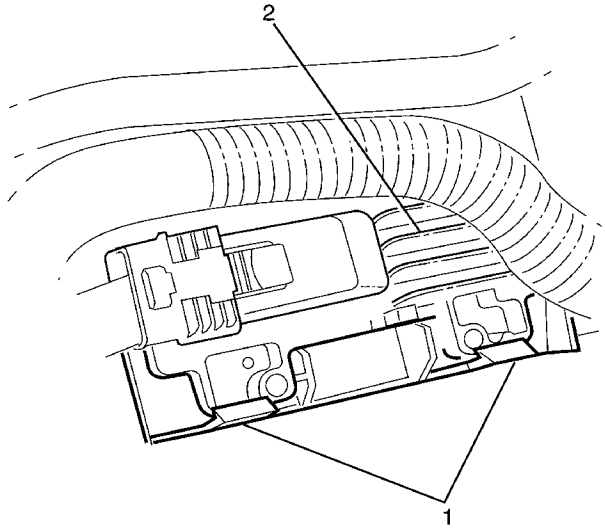
Caution: In order to prevent internal damage to the PCM, the ignition must be OFF when disconnecting or reconnecting the PCM connector.



1. Install the ECM to the vehicle.



2. Connect the ECM electrical connectors (1).



3. Engage the ECM retaining clips (1) to secure the ECM (2).
4. Connect the negative battery cable. Refer to Battery Negative Cable Disconnection and Connection.
5. If a new ECM is being installed, program the ECM. Refer to Service Programming System (SPS).

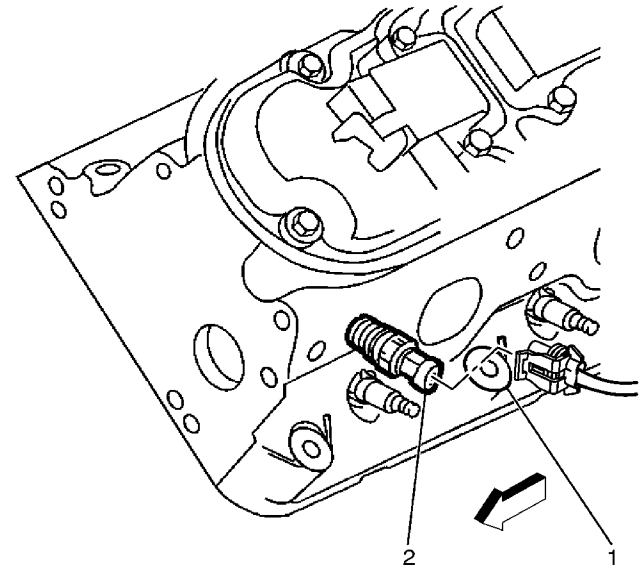
Engine Coolant Temperature Sensor Replacement

Removal Procedure

1. Turn OFF the ignition.

   Danger: To avoid any vehicle damage, serious personal injury or death when major components are removed from the vehicle and the vehicle is supported by a hoist, support the vehicle with jack stands at the opposite end from which the components are being removed and strap the vehicle to the hoist.

2. Raise the vehicle. Refer to Lifting and Jacking the Vehicle.
3. Drain the engine coolant below the level of the engine coolant temperature (ECT) sensor. Refer to Cooling System Draining and Filling.
4. Lower the vehicle.



5. Disconnect the ETC wiring harness connector (1) from the ECT sensor.

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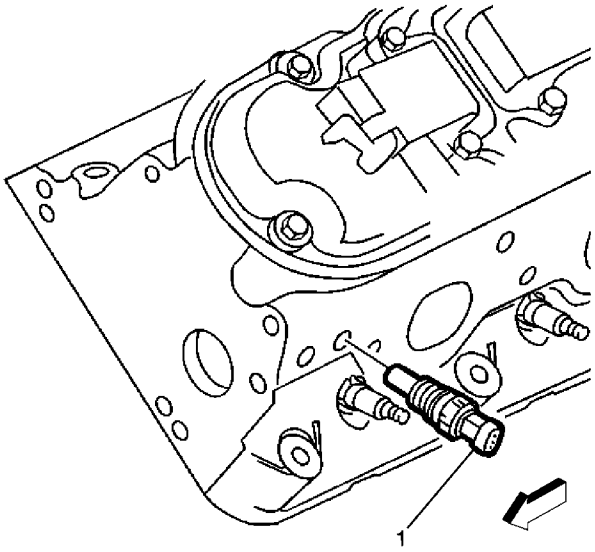


Caution: Use care when handling the coolant sensor. Damage to the coolant sensor will affect the operation of the fuel control system.

6. Remove the ECT sensor (2) from the cylinder head.

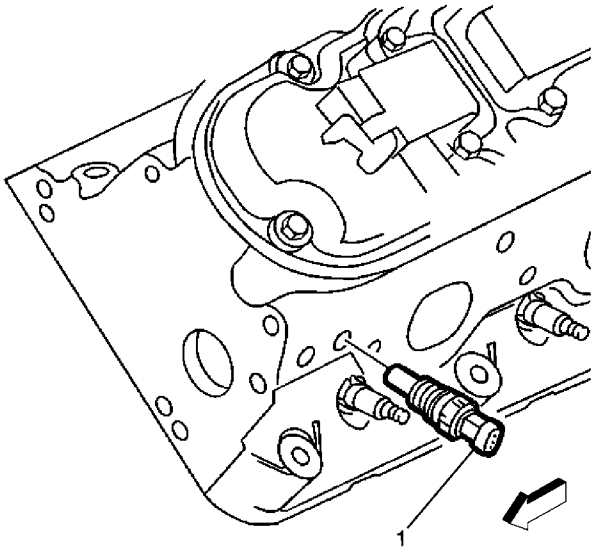
Installation Procedure

Caution: Replacement components must be the correct part number for the application. Components requiring the use of the thread locking compound, lubricants, corrosion inhibitors, or sealants are identified in the service procedure. Some replacement components may come with these coatings already applied. Do not use these coatings on components unless specified. These coatings can affect the final torque, which may affect the operation of the component. Use the correct torque specification when installing components in order to avoid damage.

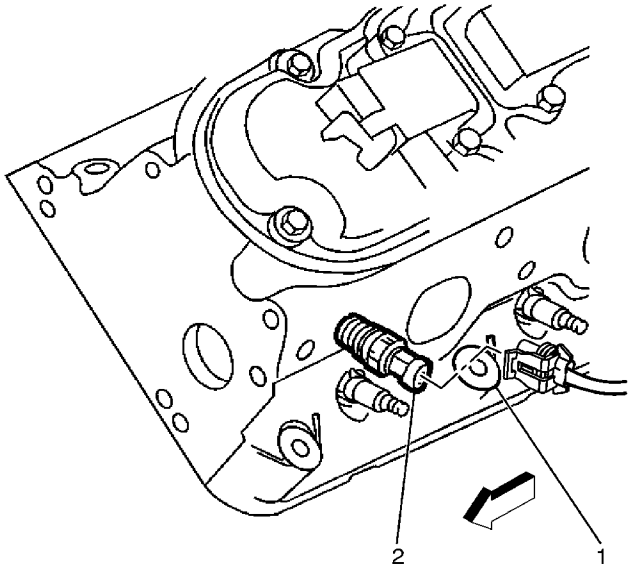
Caution: Use care when handling the coolant sensor. Damage to the coolant sensor will affect the operation of the fuel control system.

1. Coat the ECT sensor threads with sealer or the equivalent.

Caution: Refer to Fastener Caution in the Preface section.



2. Install the ECT sensor (2) to the cylinder head and tighten to **20 N·m (15 lb ft)**.

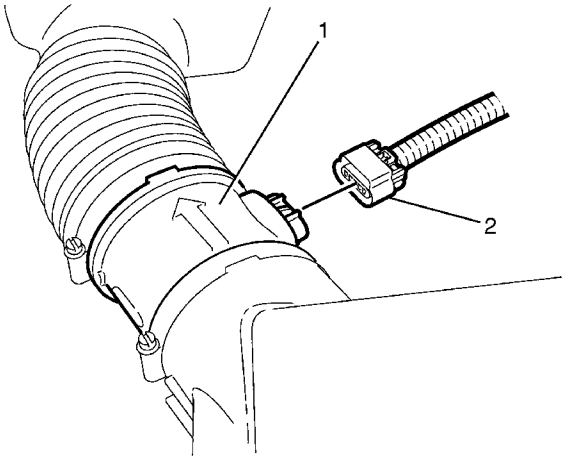


3. Connect the ETC wiring harness connector (1) ECT sensor.
4. Refill the engine coolant. Refer to Cooling System Draining and Filling.

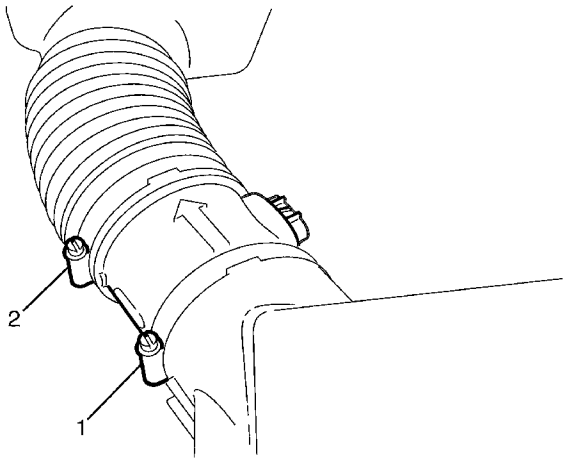
Mass Airflow Sensor with Intake Air Temperature Sensor Replacement

Removal Procedure

1. Remove the radiator and air baffle. Refer to Radiator Air Upper Baffle and Deflector Replacement.



2. Disconnect the mass air flow (MAF)/air intake temperature (IAT) wiring harness connector (2) to mass air flow (MAF)/air intake temperature (IAT) sensor (1).



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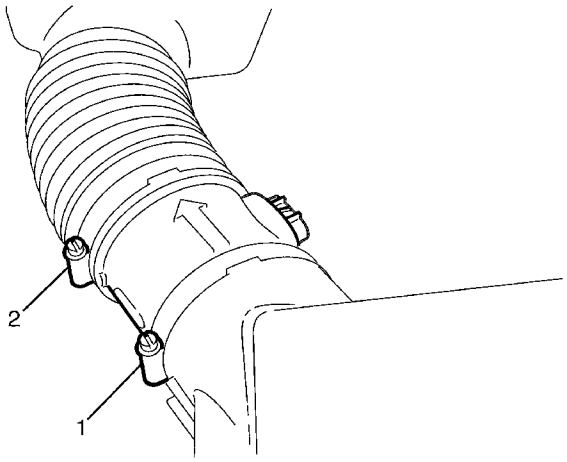
3. Loosen the air intake duct to MAF/IAT sensor retaining clamp (2).
4. Loosen the upper air cleaner body to MAF/IAT sensor retaining clamp (1).
5. Remove the air intake duct from the mass air flow MAF/IAT sensor.
6. Remove the MAF/IAT sensor (3) from the upper air cleaner body.

Installation Procedure

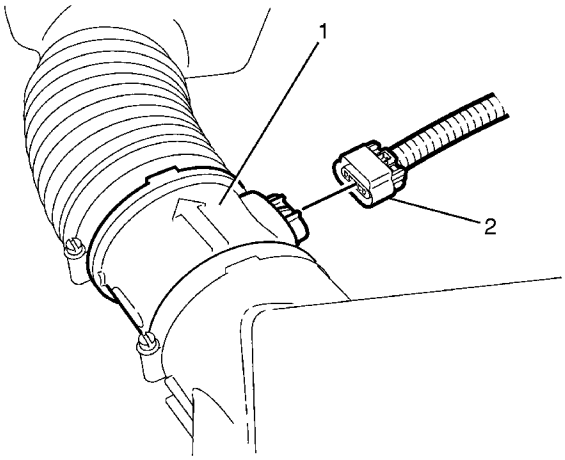


Note: Make sure that the arrow on the MAF/IAT sensor is pointing to the front, radiator, indicate the proper air flow direction. The arrow must point toward the engine.

1. Install the MAF/IAT sensor to the upper air cleaner body.
2. Install the air intake duct to the MAF/IAT sensor.
3. Position the retaining clamps (1 and 2) to the MAF/IAT sensor.

Caution: Refer to Fastener Caution in the Preface section.

4. Tighten the MAF/IAT retaining clamps (1 and 2) to **4 N·m (35 lb in)**.

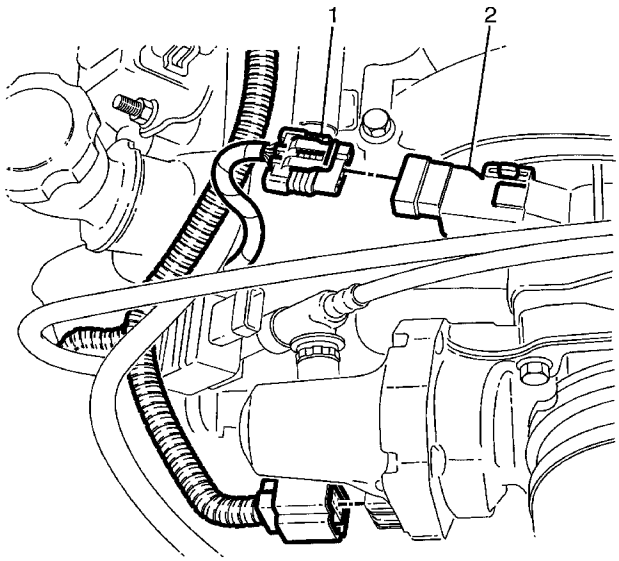


5. Connect the MAF/IAT wiring harness connector (2) to the MAF/IAT sensor.
6. If re-programming is required, refer to Control Module References.
7. Install the radiator and air baffle. Refer to Radiator Air Upper Baffle and Deflector Replacement.

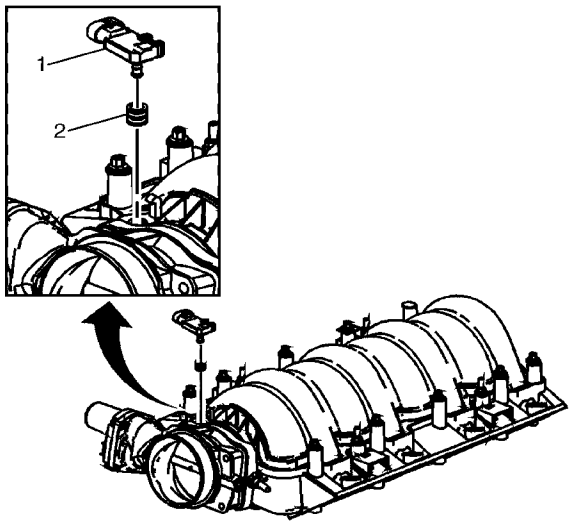
Manifold Absolute Pressure Sensor Replacement

Removal Procedure

1. Remove the oil filler cap.
2. Remove the engine cover. Refer to Engine Cover Replacement.



3. Disconnect the manifold absolute pressure (MAP) sensor wiring harness connector (1).
4. Disengage the MAP sensor (2) to MAP sensor retaining clip.



5. Remove the MAP sensor (1) from the intake manifold.
6. Check the MAP sensor seal (2) for deterioration, replace if necessary.

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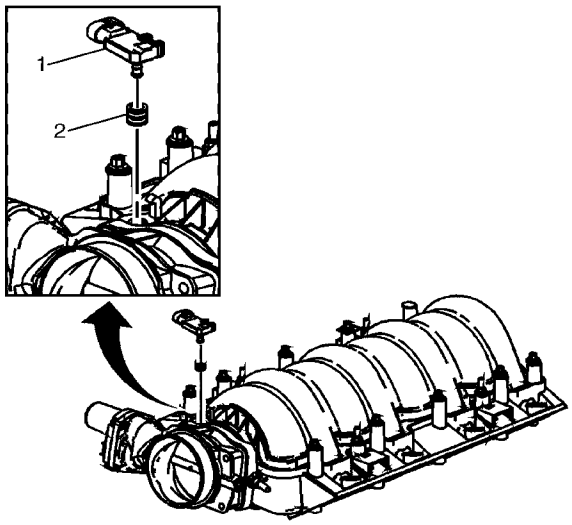
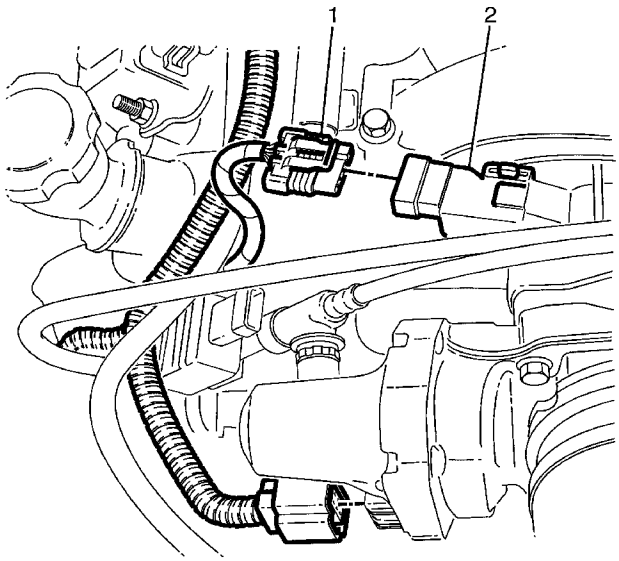
Installation Procedure



1. Install the MAP sensor (1) to the intake manifold.



2. Make sure that the MAP sensor (2) is engaged into the MAP sensor retaining clip.
3. Connect the MAP sensor wiring harness connector (1) to the MAP sensor.
4. If re-programming is required. Refer to Control Module References .
5. Install the engine cover. Refer to Engine Cover Replacement .
6. Install the oil filler cap.

Heated Oxygen Sensor Replacement - Bank 1 Sensor 1

Removal Procedure

Warning: Refer to Exhaust Service Warning in the Preface section.

Warning: Refer to Protective Goggles and Glove Warning in the Preface section.

Caution: The Heated Oxygen Sensor (HO2S) and the Oxygen Sensor use a permanently attached pigtail and connector. Do not remove this pigtail from the Heated Oxygen Sensor. Damage or the removal of the pigtail or the connector could affect the proper operation of the sensor.

Take care when handling the HO2S and the O2S. Keep the in-line electrical connector and the louvered end free of grease, dirt, or other contaminants. Also avoid using cleaning solvents of any type. Do not drop the HO2S or the O2S. Do not roughly handle the HO2S or the O2S.

Caution: Remove oxygen sensors with the engine temperature above 48°C (120°F). Otherwise the oxygen sensors may be difficult to remove.

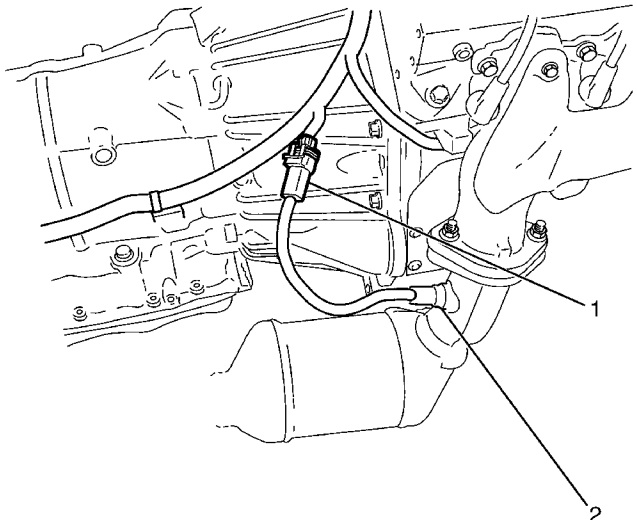
1. Ignition OFF.

   Warning: Refer to Battery Disconnect Warning in the Preface section.

2. Disconnect the battery negative cable. Refer to Battery Negative Cable Disconnection and Connection.

   Danger: To avoid any vehicle damage, serious personal injury or death when major components are removed from the vehicle and the vehicle is supported by a hoist, support the vehicle with jack stands at the opposite end from which the components are being removed and strap the vehicle to the hoist.

3. Raise and support the vehicle. Refer to Lifting and Jacking the Vehicle.



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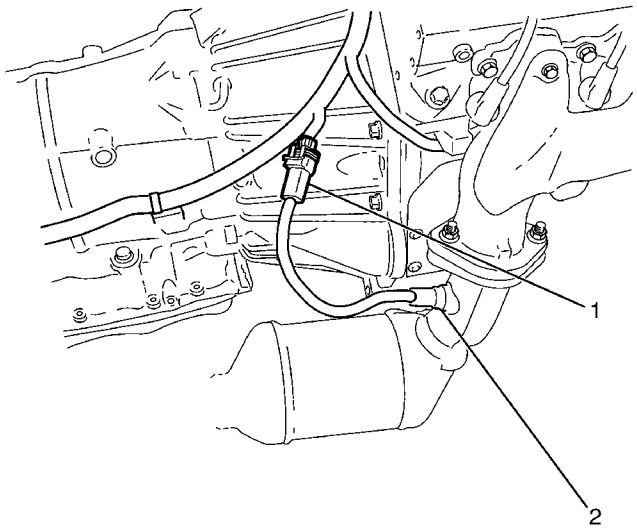
4. Disconnect the heated oxygen sensor (HO2S) electrical connector (1).
5. Remove the right catalytic converter. Refer to Catalytic Converter Replacement - Right Side.

Caution: Handle the oxygen sensors carefully in order to prevent damage to the component. Keep the electrical connector and the exhaust inlet end free of contaminants. Do not use cleaning solvents on the sensor. Do not drop or mishandle the sensor.

6. Remove the HO2S (2) from the right catalytic converter.

Installation Procedure



Caution: A special anti-seize compound is used on the oxygen sensor threads. New service sensors should already have the compound applied to the threads. Coat the threads of a reused sensor with anti-seize compound P/N 5613695 or equivalent.

1. Install the HO2S (2) to the right catalytic converter and tighten to **42 N·m (31 lb ft)**.
2. Install the right catalytic converter. Refer to Catalytic Converter Replacement - Right Side.
3. Connect the HO2S electrical connector (1).
4. Lower the vehicle.
5. Connect the battery negative cable. Refer to Battery Negative Cable Disconnection and Connection.

Heated Oxygen Sensor Replacement - Bank 1 Sensor 2

Removal Procedure

Warning: Refer to Exhaust Service Warning in the Preface section.

Warning: Refer to Protective Goggles and Glove Warning in the Preface section.

Caution: The Heated Oxygen Sensor (HO2S) and the Oxygen Sensor use a permanently attached pigtail and connector. Do not remove this pigtail from the Heated Oxygen Sensor. Damage or the removal of the pigtail or the connector could affect the proper operation of the sensor.

Take care when handling the HO2S and the O2S. Keep the in-line electrical connector and the louvered end free of grease, dirt, or other contaminants. Also avoid using cleaning solvents of any type. Do not drop the HO2S or the O2S. Do not roughly handle the HO2S or the O2S.

Caution: Remove oxygen sensors with the engine temperature above 48°C (120°F). Otherwise the oxygen sensors may be difficult to remove.

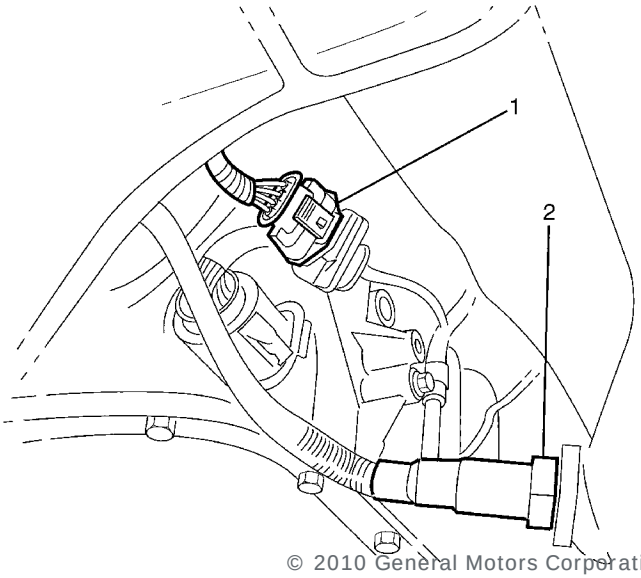
1. Ignition OFF.

   Warning: Refer to Battery Disconnect Warning in the Preface section.

2. Disconnect the battery negative cable. Refer to Battery Negative Cable Disconnection and Connection.

   Danger: To avoid any vehicle damage, serious personal injury or death when major components are removed from the vehicle and the vehicle is supported by a hoist, support the vehicle with jack stands at the opposite end from which the components are being removed and strap the vehicle to the hoist.

3. Raise and support the vehicle. Refer to Lifting and Jacking the Vehicle.



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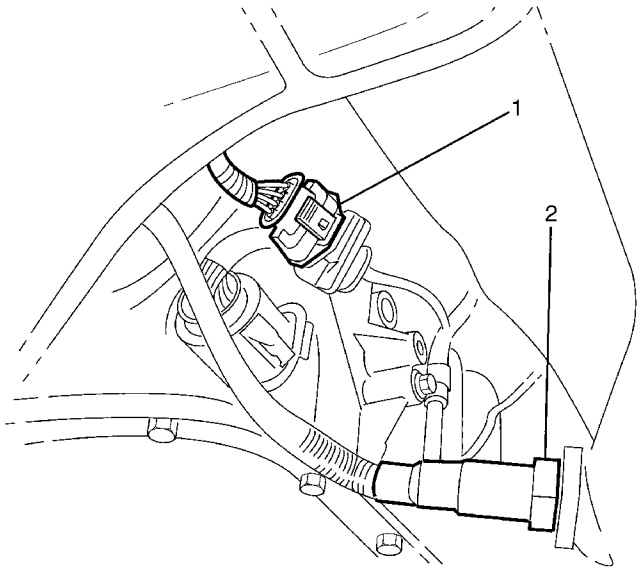
4. Disconnect the heated oxygen sensor (HO2S) electrical connector (1).

Caution: Handle the oxygen sensors carefully in order to prevent damage to the component. Keep the electrical connector and the exhaust inlet end free of contaminants. Do not use cleaning solvents on the sensor. Do not drop or mishandle the sensor.

5. Remove the HO2S (2) from the exhaust crossover pipe assembly.

Installation Procedure



Caution: A special anti-seize compound is used on the oxygen sensor threads. New service sensors should already have the compound applied to the threads. Coat the threads of a reused sensor with anti-seize compound P/N 5613695 or equivalent.

1. Install the HO2S (2) to the exhaust crossover pipe assembly and tighten to **42 N·m (31 lb ft)**.
2. Connect the HO2S electrical connector (1).
3. Lower the vehicle.
4. Connect the battery negative cable. Refer to Battery Negative Cable Disconnection and Connection.

Heated Oxygen Sensor Replacement - Bank 2 Sensor 1

Removal Procedure

Warning: Refer to Exhaust Service Warning in the Preface section.

Warning: Refer to Protective Goggles and Glove Warning in the Preface section.

Caution: The Heated Oxygen Sensor (HO2S) and the Oxygen Sensor use a permanently attached pigtail and connector. Do not remove this pigtail from the Heated Oxygen Sensor. Damage or the removal of the pigtail or the connector could affect the proper operation of the sensor.

Take care when handling the HO2S and the O2S. Keep the in-line electrical connector and the louvered end free of grease, dirt, or other contaminants. Also avoid using cleaning solvents of any type. Do not drop the HO2S or the O2S. Do not roughly handle the HO2S or the O2S.

Caution: Remove oxygen sensors with the engine temperature above 48°C (120°F). Otherwise the oxygen sensors may be difficult to remove.

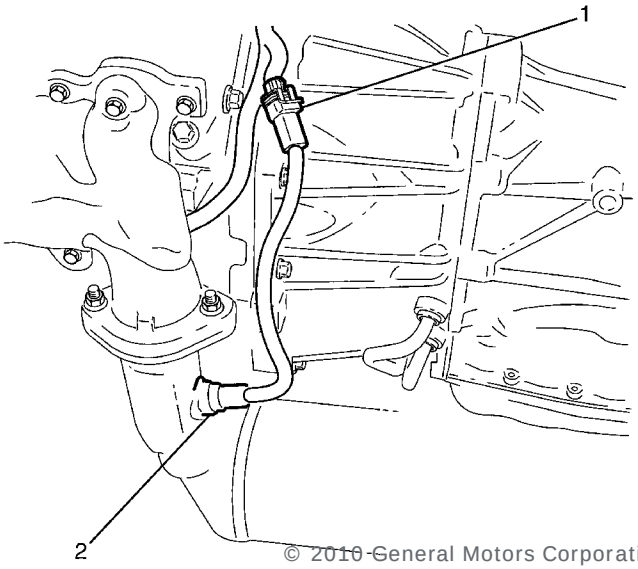
1. Ignition OFF.

   Warning: Refer to Battery Disconnect Warning in the Preface section.

2. Disconnect the battery negative cable. Refer to Battery Negative Cable Disconnection and Connection.

   Danger: To avoid any vehicle damage, serious personal injury or death when major components are removed from the vehicle and the vehicle is supported by a hoist, support the vehicle with jack stands at the opposite end from which the components are being removed and strap the vehicle to the hoist.

3. Raise and support the vehicle. Refer to Lifting and Jacking the Vehicle.



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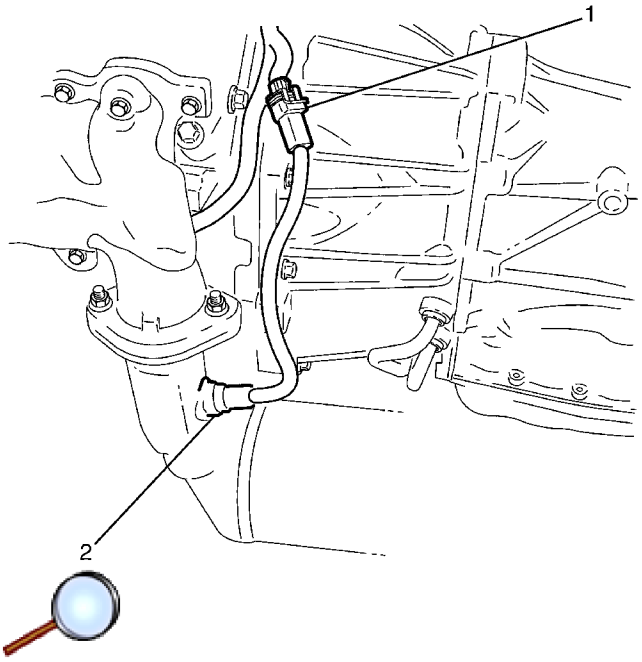
4. Disconnect the heated oxygen sensor (HO2S) electrical connector (1).
5. Remove the left catalytic converter. Refer to Catalytic Converter Replacement - Left Side.

Caution: Handle the oxygen sensors carefully in order to prevent damage to the component. Keep the electrical connector and the exhaust inlet end free of contaminants. Do not use cleaning solvents on the sensor. Do not drop or mishandle the sensor.

6. Remove the HO2S (2) from the left catalytic converter.

Installation Procedure



Caution: A special anti-seize compound is used on the oxygen sensor threads. New service sensors should already have the compound applied to the threads. Coat the threads of a reused sensor with anti-seize compound P/N 5613695 or equivalent.

1. Install the HO2S (2) to the left catalytic converter and tighten to **42 N·m (31 lb ft)**.
2. Install the left catalytic converter. Refer to Catalytic Converter Replacement - Left Side.
3. Connect the HO2S electrical connector (1).
4. Lower the vehicle.
5. Connect the battery negative cable. Refer to Battery Negative Cable Disconnection and Connection.

Heated Oxygen Sensor Replacement - Bank 2 Sensor 2

Removal Procedure

Warning: Refer to Exhaust Service Warning in the Preface section.

Warning: Refer to Protective Goggles and Glove Warning in the Preface section.

Caution: The Heated Oxygen Sensor (HO2S) and the Oxygen Sensor use a permanently attached pigtail and connector. Do not remove this pigtail from the Heated Oxygen Sensor. Damage or the removal of the pigtail or the connector could affect the proper operation of the sensor.

Take care when handling the HO2S and the O2S. Keep the in-line electrical connector and the louvered end free of grease, dirt, or other contaminants. Also avoid using cleaning solvents of any type. Do not drop the HO2S or the O2S. Do not roughly handle the HO2S or the O2S.

Caution: Remove oxygen sensors with the engine temperature above 48°C (120°F). Otherwise the oxygen sensors may be difficult to remove.

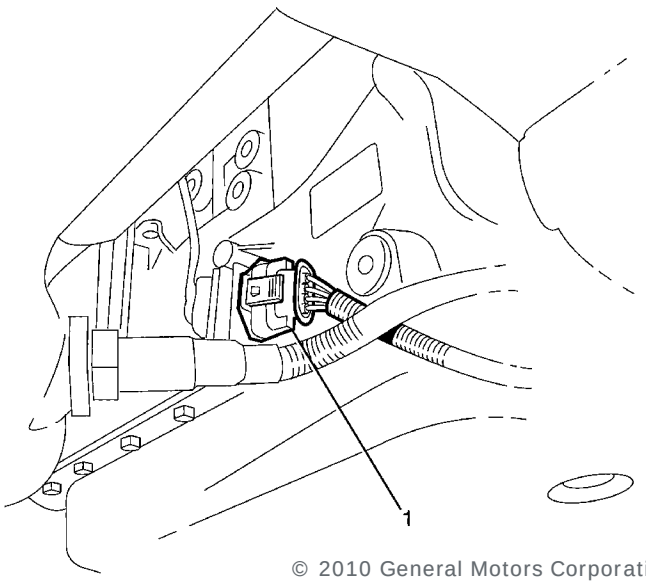
1. Ignition OFF.

   Warning: Refer to Battery Disconnect Warning in the Preface section.

2. Disconnect the battery negative cable. Refer to Battery Negative Cable Disconnection and Connection.

   Danger: To avoid any vehicle damage, serious personal injury or death when major components are removed from the vehicle and the vehicle is supported by a hoist, support the vehicle with jack stands at the opposite end from which the components are being removed and strap the vehicle to the hoist.

3. Raise and support the vehicle. Refer to Lifting and Jacking the Vehicle.



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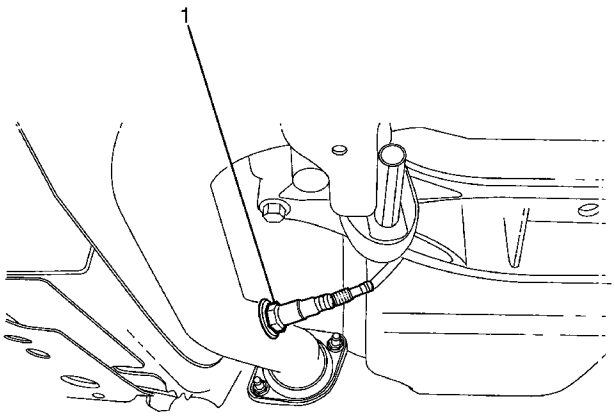
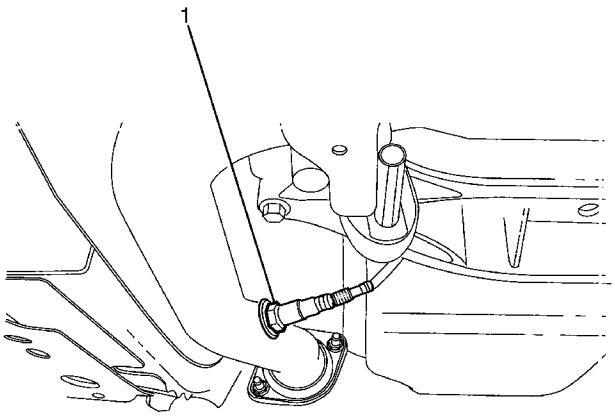
4. Disconnect the heated oxygen sensor (HO2S) electrical connector (1).



Caution: Handle the oxygen sensors carefully in order to prevent damage to the component. Keep the electrical connector and the exhaust inlet end free of contaminants. Do not use cleaning solvents on the sensor. Do not drop or mishandle the sensor.

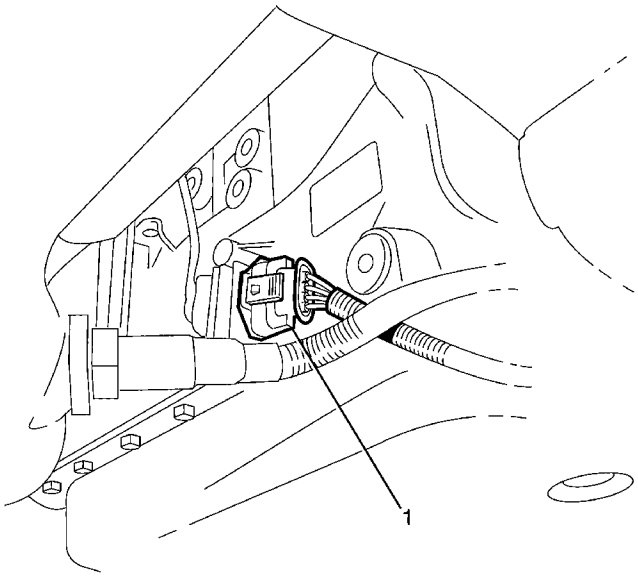
5. Remove the HO2S (2) from the exhaust crossover pipe assembly.

Installation Procedure



Caution: A special anti-seize compound is used on the oxygen sensor threads. New service sensors should already have the compound applied to the threads. Coat the threads of a reused sensor with anti-seize compound P/N 5613695 or equivalent.

1. Install the HO2S (2) to the exhaust crossover pipe assembly and tighten to **42 N·m (31 lb ft)**.

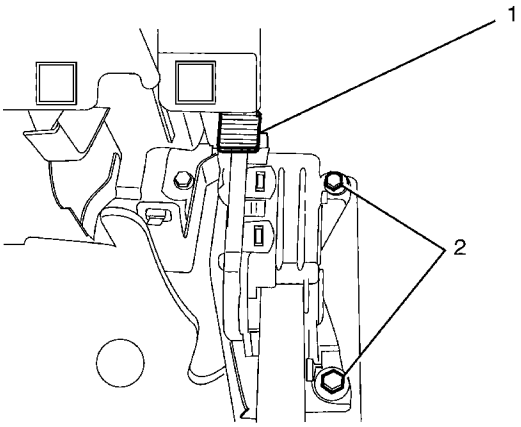


2. Connect the HO2S electrical connector (1).
3. Lower the vehicle.
4. Connect the battery negative cable. Refer to Battery Negative Cable Disconnection and Connection.

Accelerator Pedal Position Sensor Replacement

Removal Procedure

Caution: Handle the electronic throttle control components carefully. Use cleanliness in order to prevent damage. Do not drop the electronic throttle control components. Do not roughly handle the electronic throttle control components. Do not immerse the electronic throttle control components in cleaning solvents of any type.



1. Remove the left instrument panel (I/P) on the lower closeout insulator panel. Refer to Knee Bolster Replacement.
2. Disconnect the electrical connector (1) to the accelerator pedal sensor module.
3. Remove the accelerator pedal to steering column support bracket retaining bolts (2).
4. Remove the accelerator pedal.

Installation Procedure

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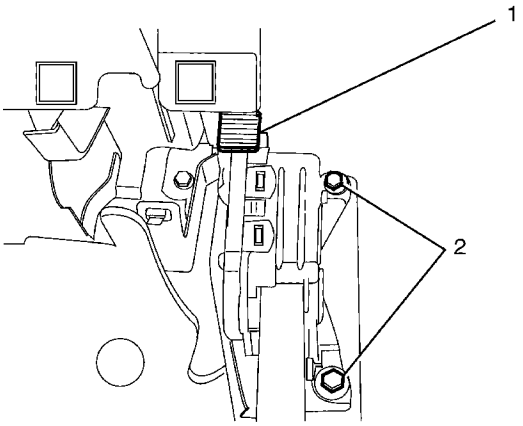


1. Install the accelerator pedal to the steering column support bracket.

   Caution: Refer to Fastener Caution in the Preface section.

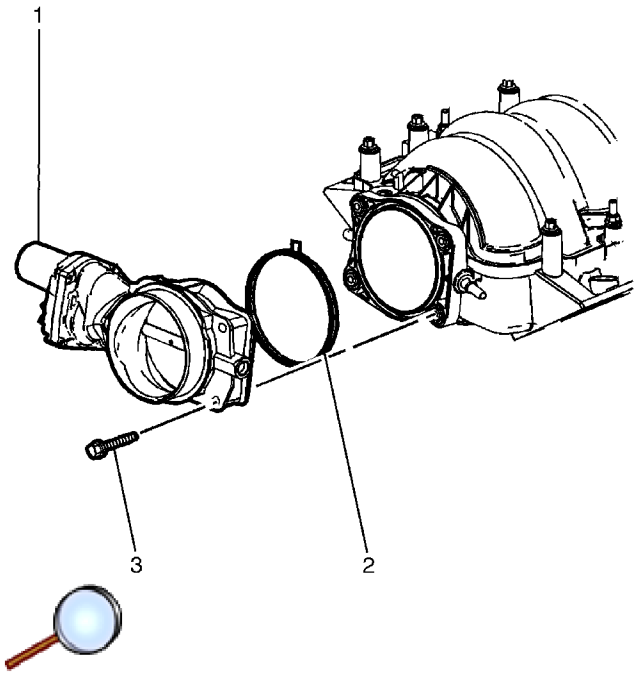
2. Install the accelerator pedal to steering column support bracket retaining bolts (2) and tighten to **20 N·m (15 lb ft)**.
3. Connect the accelerator pedal sensor module electrical connector (1).
4. Inspect for correct carpet fit under the accelerator pedal.
5. If re-programming is required, refer to Control Module References.
6. Install the left I/P on the lower closeout insulator panel. Refer to Knee Bolster Replacement.

Throttle Body Assembly Replacement

Removal Procedure

1. Remove the air intake duct. Refer to Air Cleaner Inlet Duct Replacement.

Caution: Do not insert any tools into the throttle body bore in order to avoid damage to the throttle valve plate.



Caution: Handle the electronic throttle control components carefully. Use cleanliness in order to prevent damage. Do not drop the electronic throttle control components. Do not roughly handle the electronic throttle control components. Do not immerse the electronic throttle control components in cleaning solvents of any type.

Note: The intake manifold, throttle body, fuel injection rail, and fuel injectors may be removed as an assembly. If not servicing the individual components, remove the manifold as a complete assembly.

2. Remove the electrical wire harness connector from the throttle body.
3. Remove the throttle body to intake manifold retaining bolts (3).
4. Remove the throttle body (1).

Note: The throttle body gasket is a single use part. The gasket must be discarded after removal.

5. Remove the throttle body to intake manifold gasket (2), and discard.

Discard the throttle body gasket.

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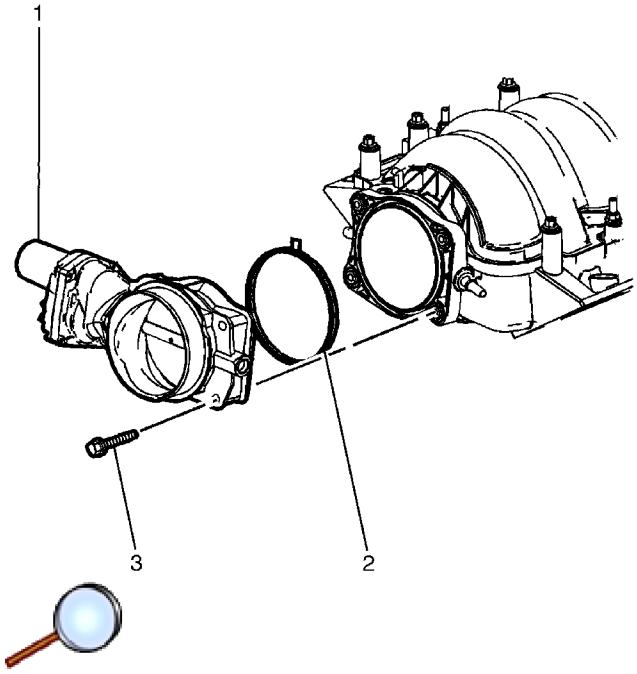
6. Clean the throttle body and intake manifold mating surfaces.

Installation Procedure



Note: DO NOT use the throttle body gasket again. Install a NEW gasket during assembly.

1. Install a new throttle body to intake manifold gasket (2). Align the locating tab of the gasket with the notch in the manifold.
2. Install the throttle body (1) to the intake manifold.

Caution: Refer to Fastener Caution in the Preface section.

3. Install the throttle body to intake manifold retaining bolts (3) and tighten to **12 N·m (106 lb in)**.
4. Install the electrical wire harness connector from the throttle body.
5. Install the air intake duct to the throttle body. Refer to Air Cleaner Inlet Duct Replacement.
6. If re-programming is required, refer to Control Module References.

Throttle Body Cleaning

Note: Over extended time and mileage, deposits may accumulate on the back of the throttle valve plate. Occasionally the deposit may accumulate to a point where perceived pedal effort is affected. This procedure should not be performed on vehicles with low mileage, under 80 450 kilometers (50,000 miles).

1. Remove the air intake duct. Refer to Air Cleaner Inlet Duct Replacement.

   Caution: Do not insert any tools into the throttle body bore in order to avoid damage to the throttle valve plate.

2. Inspect the throttle body bore and inspect the throttle valve plate for deposits. The throttle valve must be opened in order to inspect all surfaces.

   Caution: Do not use any solvent that contains Methyl Ethyl Ketone (MEK). This solvent may damage fuel system components.

3. Clean the throttle body bore and the throttle valve plate using a clean shop towel with an approved top engine cleaner.
4. Install the air intake duct. Refer to Air Cleaner Inlet Duct Replacement.

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Fuel Pressure Gage Installation and Removal

Special Tools

- DW100-010
- AU-453

Installation Procedure

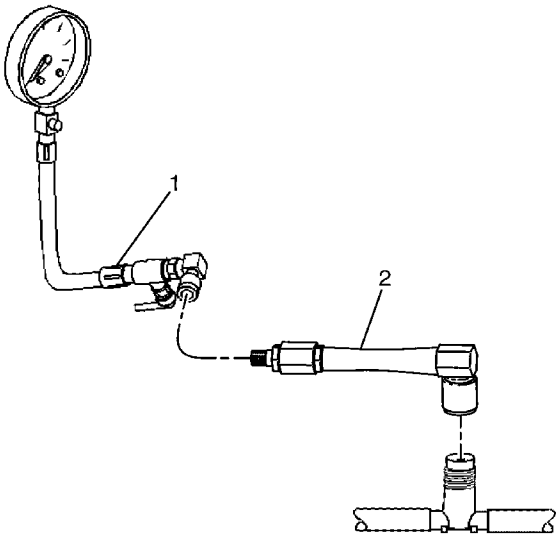
Danger: To avoid any vehicle damage, serious personal injury or death when major components are removed from the vehicle and the vehicle is supported by a hoist, support the vehicle with jack stands at the opposite end from which the components are being removed and strap the vehicle to the hoist.

Warning: Wrap a shop towel around the fuel pressure connection in order to reduce the risk of fire and personal injury. The towel will absorb any fuel leakage that occurs during the connection of the fuel pressure gage. Place the towel in an approved container when the connection of the fuel pressure gage is complete.

Caution: Clean all of the following areas before performing any disconnections in order to avoid possible contamination in the system:

- The fuel pipe connections
- The hose connections
- The areas surrounding the connections

1. Remove the engine covers. Refer to Engine Cover Replacement.



2. Remove the fuel pressure service connection dust cap from the fuel rail.
3. Connect the AU-453 (1) fuel pressure test hose adapter to the fuel pressure connection.

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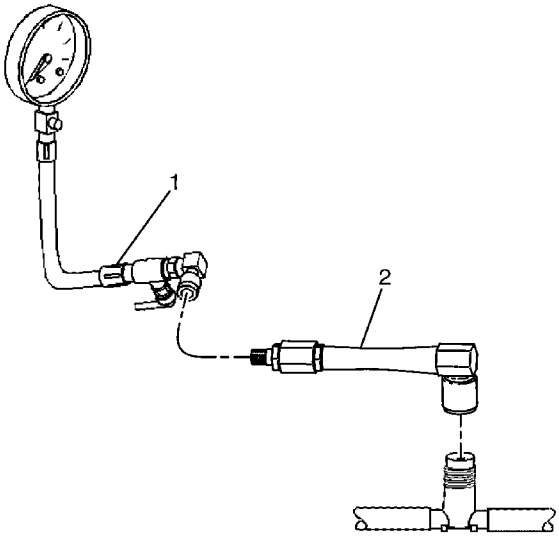
Wrap a shop towel around the fitting while connecting the AU-453 (1) in order to avoid spillage.
4. Connect the DW100-010 (2) fuel pressure gage to the AU-453 (1). Wrap a shop towel around the fitting while connecting the gage in order to avoid spillage.
5. Turn ON the ignition.

Warning: Do not drain the fuel into an open container. Never store the fuel in an open container due to the possibility of a fire or an explosion.

6. Place the bleed hose of the fuel pressure gage into a suitable container.
7. Open the bleed valve on the fuel pressure gage in order to bleed the air from the fuel pressure gage.
8. Command the fuel pump ON with a scan tool.
9. Close the bleed valve on the fuel pressure gage.
10. Inspect for fuel leaks.

Removal Procedure

1. Turn OFF the ignition.
2. Command the fuel pump OFF with the scan tool.
3. Open the bleed valve on the fuel pressure gage in order to bleed the remaining fuel from the fuel pressure gage.
4. Remove the bleed hose from the fuel pressure gage.



5. Disconnect the DW100-010 (2) fuel pressure gage from the AU-453 (1). Wrap a shop towel around the fitting while connecting the gage in order to avoid spillage.
6. Disconnect the AU-453 (1) fuel pressure test hose adapter to the fuel pressure connection. Wrap a shop towel around the fitting while connecting the AU-453 (1) in order to avoid spillage.
7. Install the fuel pressure service connection dust cap to the fuel rail.
8. Install the engine covers. Refer to Engine Cover Replacement.

Fuel Pressure Relief

Tools Required

- J 29658-D Fuel Pressure Gage
- AU-453 Fuel Pressure Test Hose Adapter

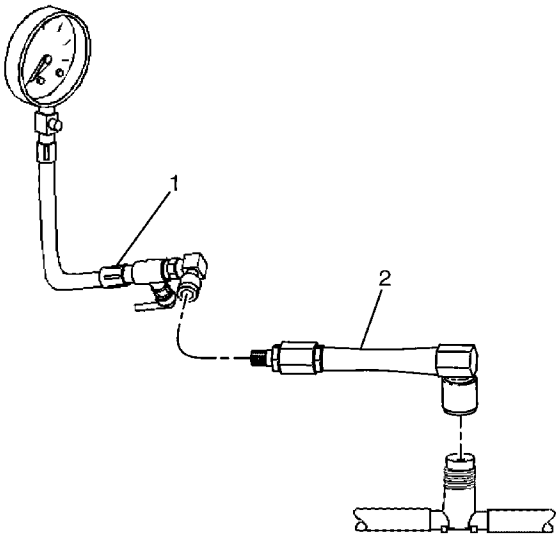
Warning: Gasoline or gasoline vapors are highly flammable. A fire could occur if an ignition source is present. Never drain or store gasoline or diesel fuel in an open container, due to the possibility of fire or explosion. Have a dry chemical (Class B) fire extinguisher nearby.

Warning: Relieve the fuel system pressure before servicing fuel system components in order to reduce the risk of fire and personal injury.

After relieving the system pressure, a small amount of fuel may be released when servicing the fuel lines or connections. In order to reduce the chance of personal injury, cover the regulator and the fuel line fittings with a shop towel before disconnecting. This will catch any fuel that may leak out. Place the towel in an approved container when the disconnection is complete.

Warning: Refer to Safety Glasses Warning in the Preface section.

1. Turn the ignition OFF.
2. Disconnect the negative battery cable in order to avoid possible fuel discharge if an accidental attempt is made to start the engine. Refer to Battery Negative Cable Disconnection and Connection.
3. Remove the fuel injector sight shield.



4. Connect the EN-47620 (1) fuel pressure test hose adapter to the fuel pressure connection. Wrap a shop towel around the fitting while connecting the J 29658-D (1) in order to avoid spillage.
5. Connect the J 29658-D (2) fuel pressure gage to the EN-47620 (1). Wrap a shop towel

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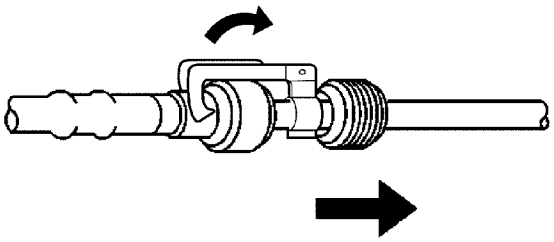
around the fitting while connecting the gage in order to avoid spillage.
6. Install the bleed hose into an approved container.
7. Open the valve in order to bleed the system pressure. Fuel connections are now safe for servicing.
8. Drain any fuel remaining in the gauge into an approved container.
9. Install the fuel injector sight shield.
10. Connect the negative battery cable. Refer to Battery Negative Cable Disconnection and Connection.

Metal Collar Quick Connect Fitting Service

Special Tools

- 7370 Fuel Line Quick Connect Separator
- 7371 Fuel Line Quick Connect Separator
- J 37088-A Fuel Line Quick Connect Separator

Removal Procedure



1. Before you service any fuel system connection, relieve the fuel system pressure. Refer to the Fuel Pressure Relief.
2. Slide the dust cover from the quick-connect fitting if fitted.
3. Disconnect the fuel hose clip verifier from the quick connect fitting.

Warning: Wear safety glasses when using compressed air, as flying dirt particles may cause eye injury.

4. Use compressed air in order to blow any dirt from the fitting.

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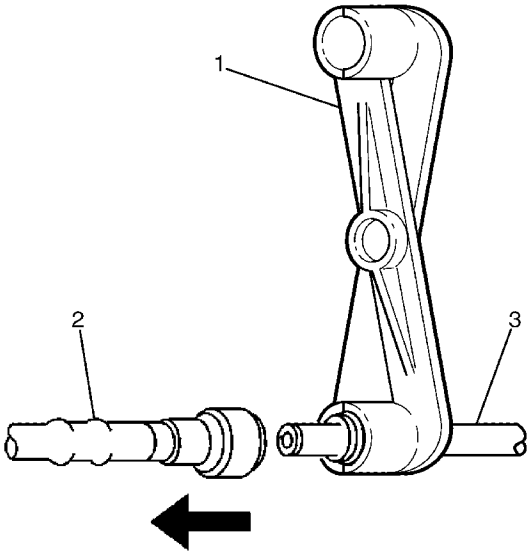
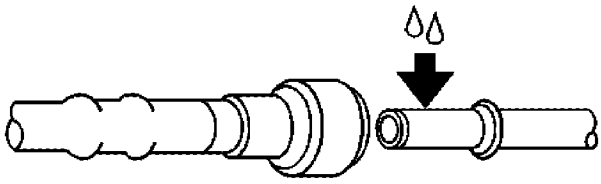


5. Choose the correct tool (1) for the size of the fitting from J 37088-A , 7370 or 7371 . Insert the selected tool into the male connector (3), then push inward in order to release the locking tabs.
6. Pull the female connector (2) away from the male connector.
7. Remove the J 37088-A Fuel Line Quick Connect Separator, 7370 or 7371 from the male connector.

Caution: If necessary, remove rust or burrs from the fuel pipes with an emery cloth. Use a radial motion with the fuel pipe end in order to prevent damage to the O-ring sealing surface. Use a clean shop towel in order to wipe off the male tube ends. Inspect all the connections for dirt and burrs. Clean or replace the components and assemblies as required.

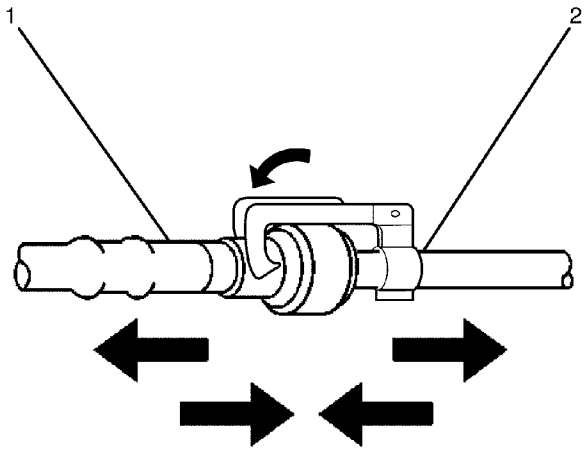
8. Using a clean shop towel, wipe off the male pipe end.
9. Inspect both ends of the fitting for dirt and for burrs. Clean or replace the components as required.

Installation Procedure

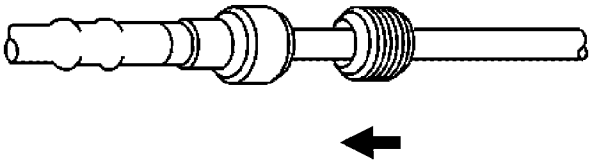


Warning: Always apply a few drops of clean engine oil to the male pipe ends before connecting the fuel pipe fittings in order to reduce the risk of fire and personal injury. This will ensure proper reconnection and prevent a possible fuel leak. During normal operation, the O-rings located in the female connector will swell and may prevent proper reconnection if not lubricated.

1. Apply a few drops of clean engine oil to the male pipe end.
2. Push both sides of the fitting together in order to cause the retaining tabs to snap into place.



3. Pull and push repeatedly on both sides (1 and 2) of the fitting to make sure the connection is secure.
4. Connect the fuel hose clip verifier from the quick connect fitting.



5. Reposition the dust cover over the quick-connect fitting if fitted.

Plastic Collar Quick Connect Fitting Service

Tools Required

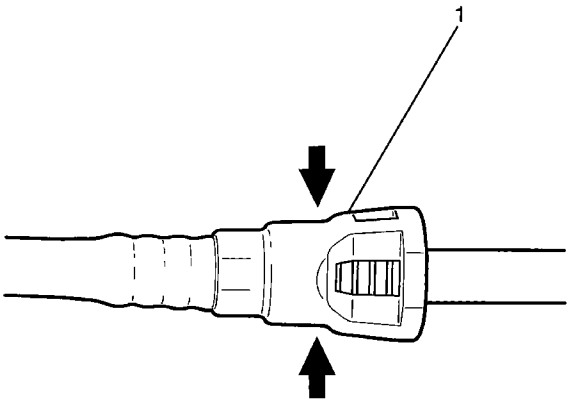
AU-533

Removal Procedure

Warning: Refer to Gasoline/Gasoline Vapors Warning in the Preface section.

Warning: Refer to Safety Glasses Warning in the Preface section.

1. Relieve the fuel system pressure. Refer to Fuel Pressure Relief.
2. Blow dirt out of the fitting using compressed air.



3. Install the quick connect tool over the quick connect fitting (1).

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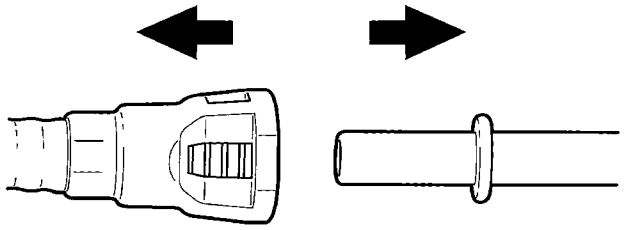


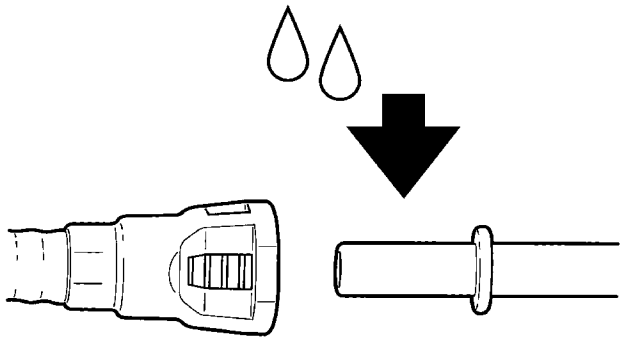
4. Pull the connection apart.
5. Using a clean shop towel, wipe off the male pipe end.
6. Inspect both ends of the fitting for dirt and burrs.
7. Clean or replace the components as required.

Installation Procedure

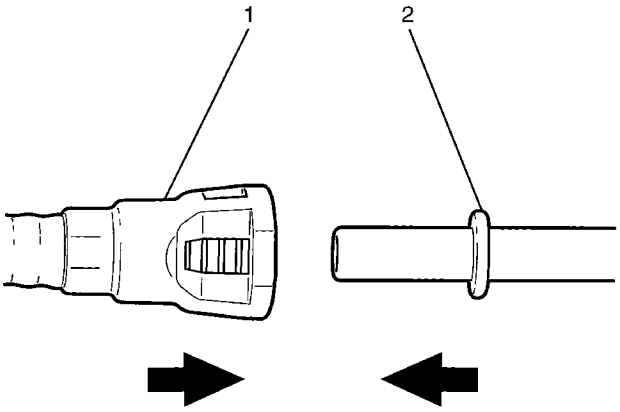
Warning: In order to reduce the risk of fire and personal injury, before connecting fuel pipe fittings, always apply a few drops of clean engine oil to the male pipe ends.

This will ensure proper reconnection and prevent a possible fuel leak.

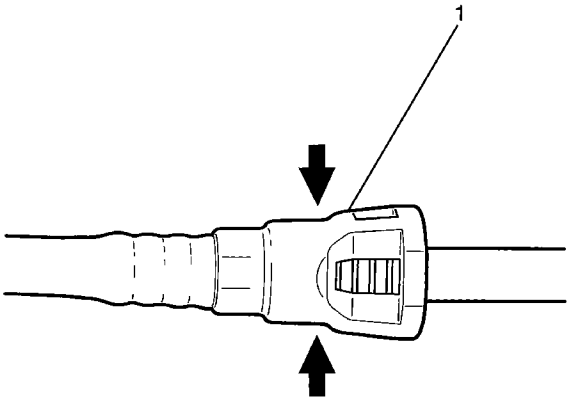
During normal operation, the O-rings located in the female connector will swell and may prevent proper reconnection if not lubricated.



1. Apply a few drops of clean engine oil to the male pipe end.



2. Push both sides (1 and 2) of the quick-connect fitting together to cause the retaining tabs/fingers to snap into place.



3. Pull on both sides of the quick-connect fitting (1) to make sure the connection is secure.
4. Inspect for leaks using the following procedure:
   4.1. Turn the ignition ON, with the engine OFF for 2 seconds.
   4.2. Turn the ignition OFF, for 10 seconds.
   4.3. Turn the ignition ON, with the engine OFF for 2 seconds.
   4.4. Turn the ignition OFF.
   4.5. Inspect for leaks.

Fuel Filter Replacement

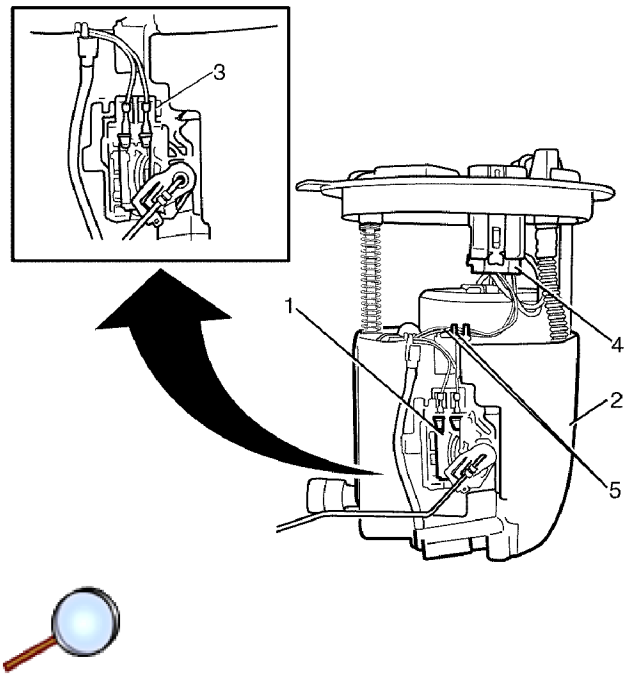
Removal Procedure

Warning: Refer to Gasoline/Gasoline Vapors Warning in the Preface section.

Warning: Refer to Safety Glasses Warning in the Preface section.

Danger: To avoid any vehicle damage, serious personal injury or death when major components are removed from the vehicle and the vehicle is supported by a hoist, support the vehicle with jack stands at the opposite end from which the components are being removed and strap the vehicle to the hoist.

1. Remove the fuel tank. Refer to Fuel Tank Replacement.
2. Remove the primary fuel tank module assembly from the fuel tank. Refer to Primary Fuel Tank Module Replacement.



3. Disconnect the fuel level sensor connector (4) and unclip the wiring from the harness securing clips (5).
4. Unlock the locking clip (3) and gently push the fuel level sensor upwards.
5. Remove the fuel level sensor (1) from the lower half of the primary fuel tank module assembly (2).

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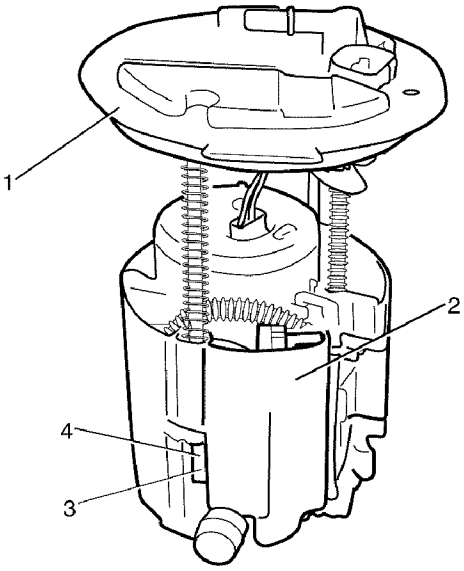
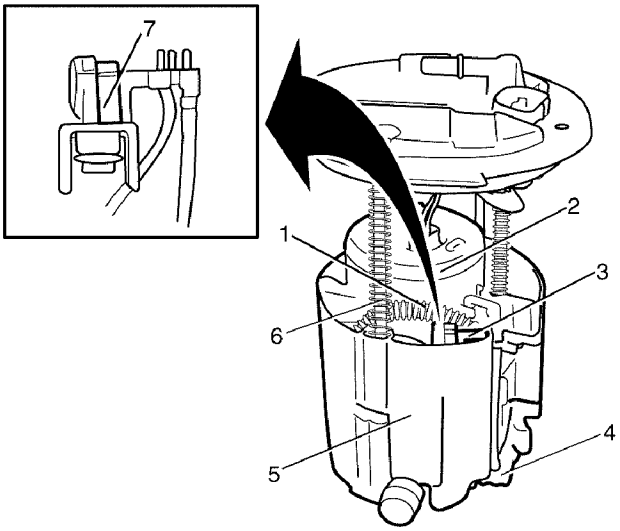
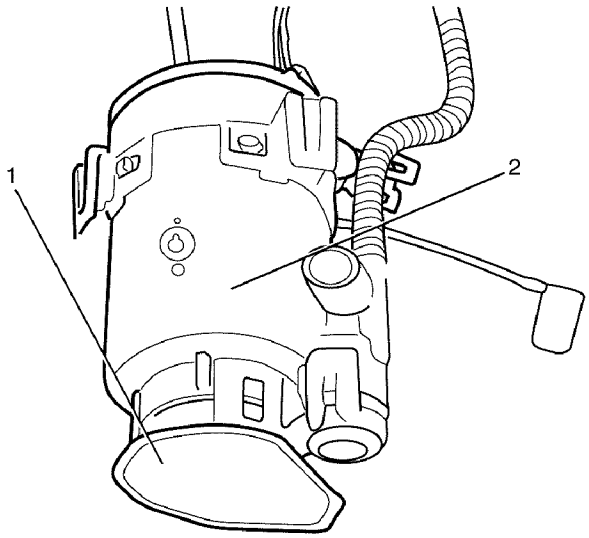


6. Press down on the primary fuel tank module assembly upper half and remove the circlip (3) from the shaft (4).
7. Separate the upper halve (1) and lower halve (2) of the primary fuel tank module assembly.

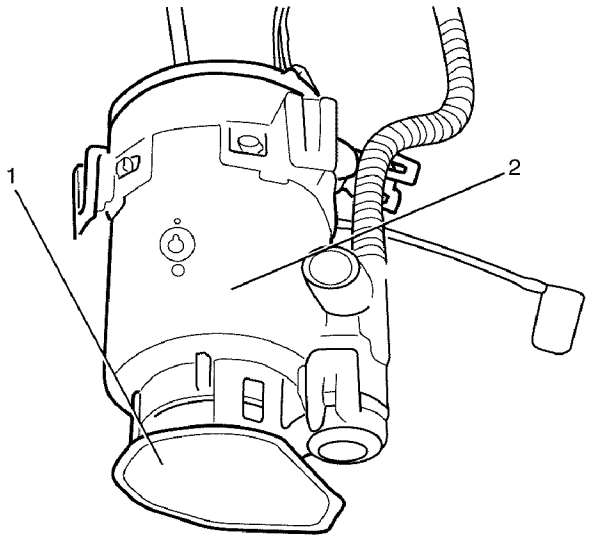


8. Remove the spring (6) from the primary fuel tank module assembly (5).
9. Unclip the piping (4) with a suitable tool.
10. Unclip the connector (7) with a suitable tool.
11. Make a note of the routing of the pipes (1) and (3).
12. Carefully remove the fuel pump housing (2) from the primary fuel tank module assembly (5).

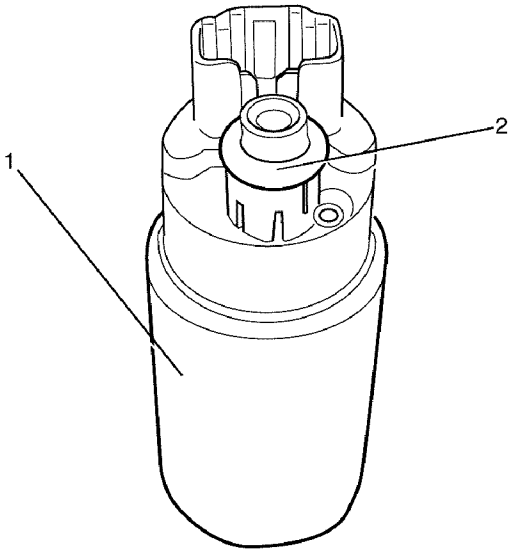


13. Carefully pry the fuel filter (2) from the fuel pump housing (3).

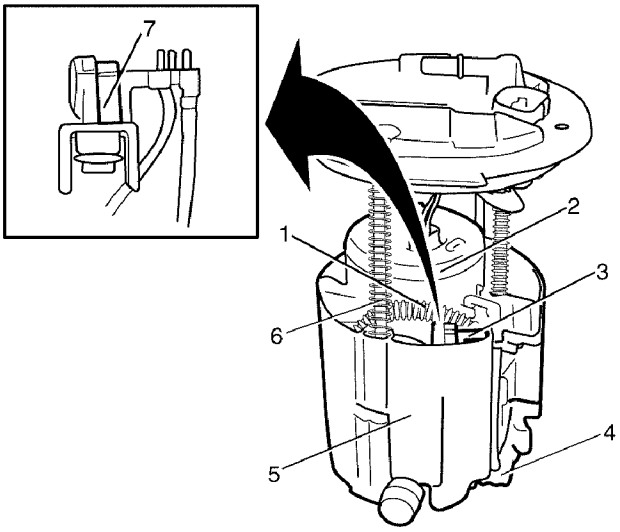
Installation Procedure



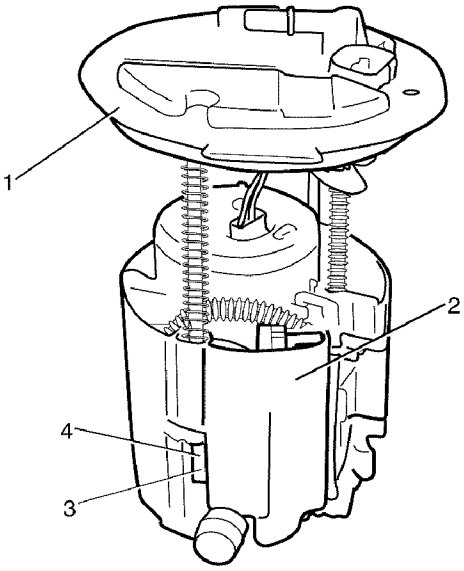
1. Locate and attach the fuel filter (1) to the fuel pump housing (3).



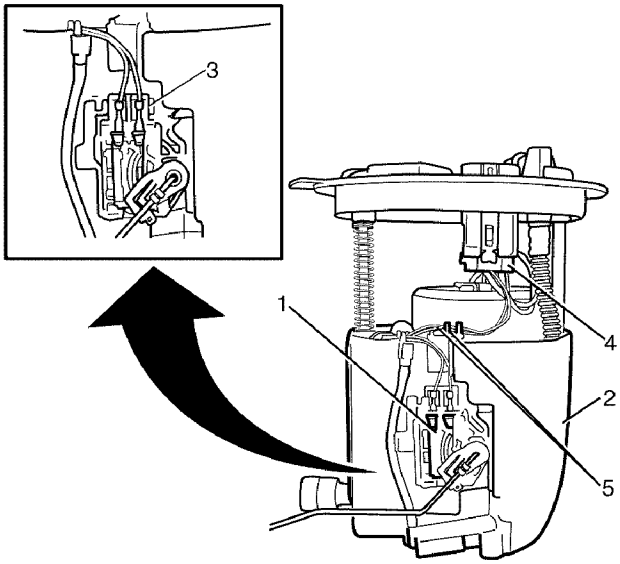
2. Fit a NEW O-ring seal (1) to the fuel outlet (2) and lubricate the NEW O-ring seal with an approved lubricant.



3. Route pipes (1) and (3) as noted earlier.
4. Press down on connector and listen for an audible click to confirm fitment.
5. Locate and install the fuel pump housing (2) into the primary fuel tank module assembly (5).
6. Locate and install the piping (4) to the primary fuel tank module assembly (5). Listen for audible click to confirm fitment.
7. Install the spring (6) to the fuel tank module assembly (5).



8. Assemble the primary fuel tank module assembly (1 and 2).
9. Press down on the primary fuel tank module assembly and install the circlip (3) to the shaft (4).



10. Locate and install the fuel tank level sensor (1) to the primary fuel tank module assembly (2). Make sure that the locking clip (3) engages.
11. Connect the fuel level sensor connector (4) and route the wiring through the harness securing clips (5).
12. Install the primary fuel tank module assembly from the fuel tank. Refer to Primary Fuel Tank Module Replacement.
13. Install the fuel tank. Refer to Fuel Tank Replacement.

Fuel Tank Draining

Special tools

- J 45004
- J 42960-2
- Commercially Available Fuel Pump

Fuel Tank Draining Method 1

1. Ignition OFF.

   Warning: Refer to Battery Disconnect Warning in the Preface section.

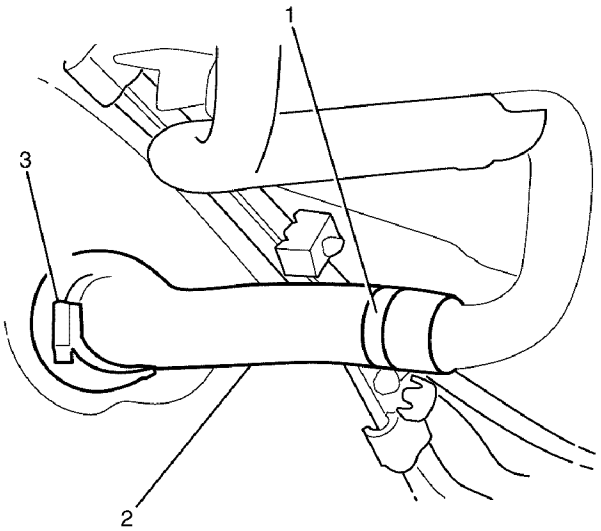
2. Disconnect the battery negative cable. Refer to Battery Negative Cable Disconnection and Connection.

   Warning: Refer to Safety Glasses Warning in the Preface section.

   Danger: To avoid any vehicle damage, serious personal injury or death, always use the jackstands to support the vehicle when lifting the vehicle with a jack.

3. Raise and support the vehicle. Refer to Lifting and Jacking the Vehicle.
4. Remove the right rear wheel. Refer to Tire and Wheel Removal and Installation.

   Warning: Refer to Gasoline/Gasoline Vapors Warning in the Preface section.



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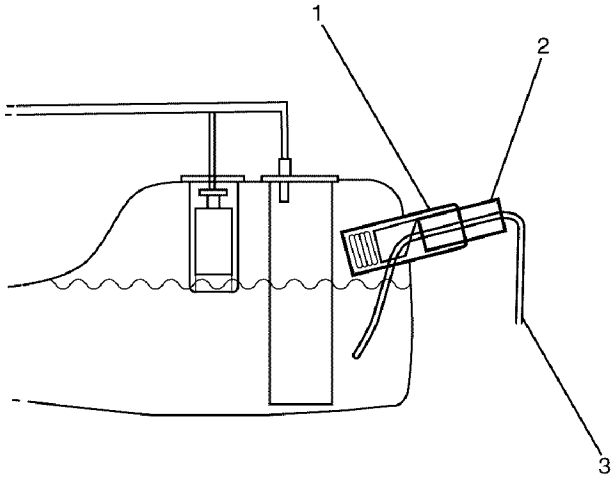
Warning: Never drain or store fuel in an open container. Always use an approved fuel storage container in order to reduce the chance of fire or explosion.

5. Remove the retaining hose clamp (1) from the fuel filler hose (2).
6. Remove the retaining hose clamp (3) from the fuel filler hose (2).
7. Remove the fuel filler hose (2) from the vehicle.

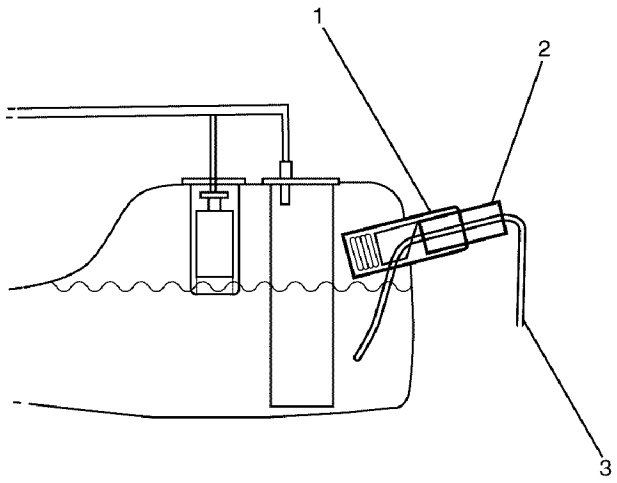


Note: Up to approximately 36 liters (8 gallons) of residual fuel may remain in the secondary side of the fuel tank.

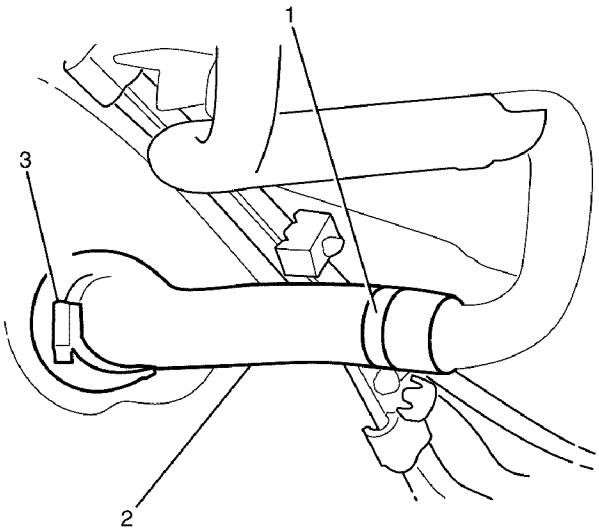
Note: The J 42960-2 (2) is used to keep the roll over anti spill valve open.

8. Install the J 42960-2 (2) into the fuel tank fuel filler pipe (1).
9. Insert the J 45004 (3) into the J 42960-2 (2) until the J 45004 (3) reaches the bottom of the tank.
10. Use a commercially available pump to drain the fuel from the fuel tank.

Adding The Drained Fuel to The Tank.



1. Remove the J 45004 (3) from the J 42960-2 (2).
2. Remove the J 42960-2 (2) from the fuel tank fuel filler pipe (1).



Warning: Never drain or store fuel in an open container. Always use an approved fuel storage container in order to reduce the chance of fire or explosion.

3. Install the fuel filler hose (2) to the vehicle.

Caution: Refer to Fastener Caution in the Preface section.

4. Install the retaining hose clamp (3) to the fuel filler hose (2) and tighten to **4 N·m (35 lb in).**
5. Install the retaining hose clamp (1) to the fuel filler hose (2) and tighten to

4 N·m (35 lb in).

6. Install the right rear wheel. Refer to Tire and Wheel Removal and Installation.
7. Lower the vehicle to the ground. Refer to Lifting and Jacking the Vehicle.
8. Add the drained fuel to the fuel tank.
9. Connect the battery negative cable. Refer to Battery Negative Cable Disconnection and Connection.

Fuel Tank Draining Method 2

Special Tools

J 34730-1A

1. Install the fuel pressure gage to the vehicle. Refer to Fuel Tank Draining.
2. Place the bleed hose of the fuel pressure gage into a suitable container.

Note: Do not leave the vehicle unattended when performing this procedure.

3. Command the fuel pump ON with a scan tool.

Note: Do not fully open the bleed valve on the fuel pressure gage. To drain both sides of the fuel tank simultaneously there should be a restriction on the flow rate at the bleed hose.

4. Open the bleed valve on the fuel pressure gage just enough to cause a restriction to the flow of the fuel rate at the bleed hose.

Note: To avoid damage to the fuel pump do not allow the fuel pump to run dry while the fuel pump is in the ON state.

5. Command the fuel pump OFF with the scan tool as soon as it is observed that no more fuel is coming out of the bleed hose.
6. Remove the fuel pressure gage from the vehicle. Refer to Fuel Tank Draining.

Filler Tube Replacement

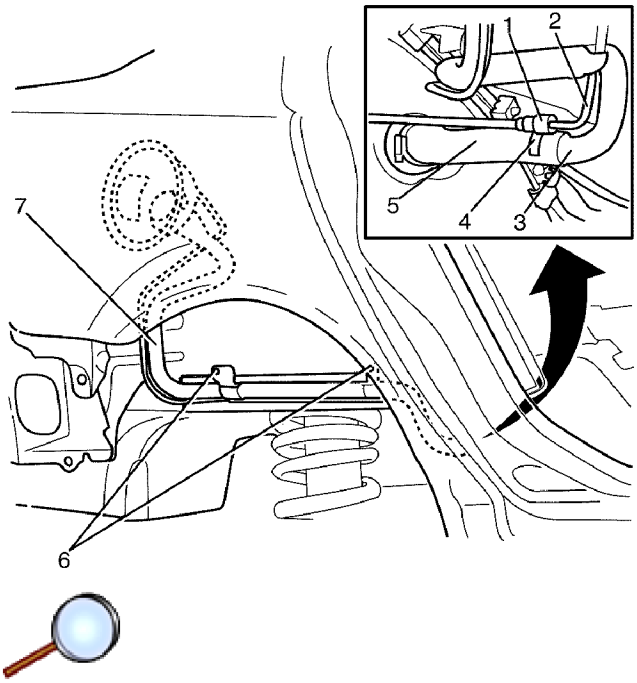
Removal Procedure

1. Remove the fuel filler cap.

   Warning: Refer to Safety Glasses Warning in the Preface section.

   Danger: To avoid any vehicle damage, serious personal injury or death when major components are removed from the vehicle and the vehicle is supported by a hoist, support the vehicle with jack stands at the opposite end from which the components are being removed and strap the vehicle to the hoist.

2. Raise and support the vehicle. Refer to Lifting and Jacking the Vehicle.
3. Drain the fuel tank below the level of the fuel filler hose. Refer to Fuel Tank Draining.
4. Remove the right rear wheel. Refer to Tire and Wheel Removal and Installation.
5. Remove the right rear wheelhouse Liner. Refer to Rear Inner Wheelhouse Replacement.
6. Remove the rear bumper fascia. Refer to Rear Bumper Fascia Replacement.



7. Remove the filler tube to chassis retaining bolts (6).
8. Disconnect the evaporative emission (EVAP) line (2) from the quick connect fitting (1). Refer to Plastic Collar Quick Connect Fitting Service.
9. Remove the retaining hose clamp (4).
10. Disconnect the fuel filler tube (3) from the fuel filler hose (5).
11. Manoeuvre the fuel filler tube (7) and remove from the vehicle.

Installation Procedure

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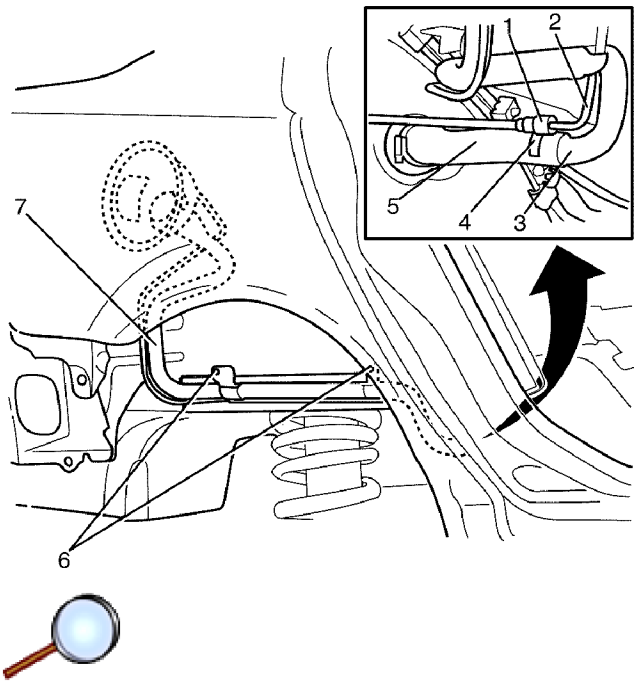


1. Install the fuel filler tube (7) to the vehicle.
2. Connect the fuel filler tube (3) to the fuel filler hose (5).

Caution: Refer to Fastener Caution in the Preface section.

3. Install the retaining hose clamp (4) the fuel filler tube hose clamp (3) to 3.5 N·m (31 lb in).

Note: Listen for an audible click to confirm correct installation.

4. Connect the evaporative emission (EVAP) line (2) to the quick connect fitting (1).
5. Install the filler tube to chassis retaining bolts (6) and tighten to 9 N·m (80 lb in).
6. Install the rear bumper fascia. Refer to Rear Bumper Fascia Replacement.
7. Install the right rear wheelhouse Liner. Refer to Rear Inner Wheelhouse Replacement.
8. Install the right rear wheel. Refer to Tire and Wheel Removal and Installation.

Fuel Tank Replacement

Special Tools

EN-48536 Frame Support Tool (Engine Lower 65 mm Kit)

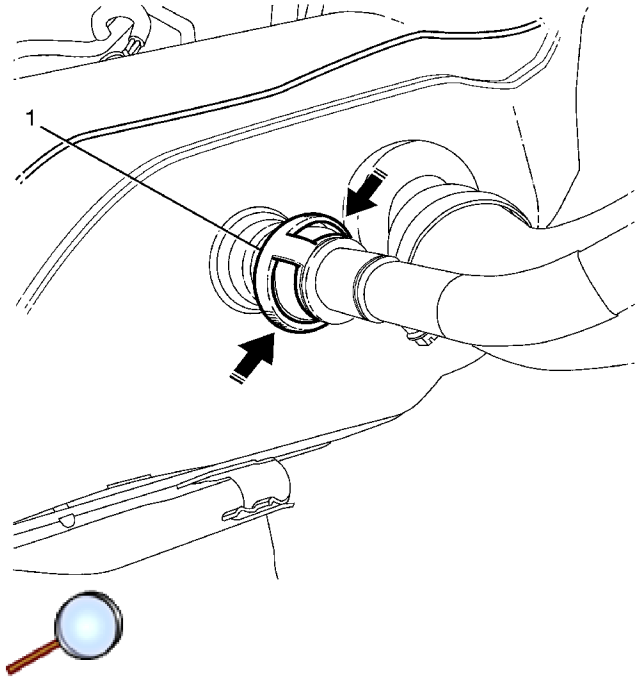
Removal Procedure

Warning: Refer to Gasoline/Gasoline Vapors Warning in the Preface section.

Warning: Refer to Safety Glasses Warning in the Preface section.

Danger: To avoid any vehicle damage, serious personal injury or death when major components are removed from the vehicle and the vehicle is supported by a hoist, support the vehicle with jack stands at the opposite end from which the components are being removed and strap the vehicle to the hoist.

1. Raise and support the vehicle. Refer to Lifting and Jacking the Vehicle.
2. Drain the fuel tank. Refer to Fuel Tank Draining.
3. Relieve the fuel system pressure. Refer to Fuel Pressure Relief.
4. Remove the exhaust system. Refer to Exhaust System Replacement.
5. Remove the propeller shaft. Refer to Propeller Shaft Replacement.
6. Remove the right rear wheel. Refer to Tire and Wheel Removal and Installation.



7. Disconnect the evaporative emission (EVAP) line (1), by squeezing both sides of the line, as indicated in the illustration, and pulling it toward the rear of the vehicle.

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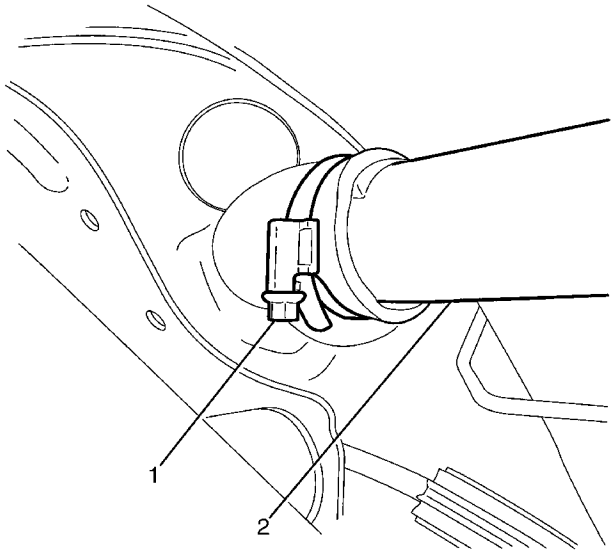
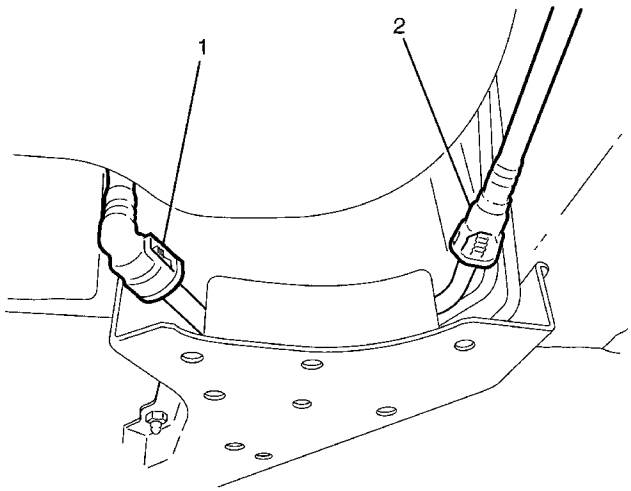
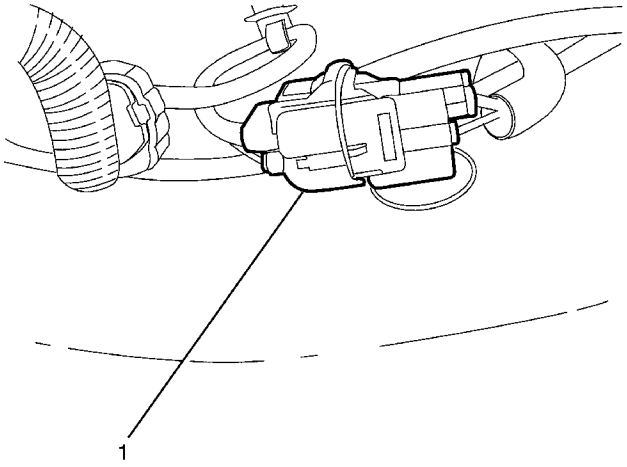


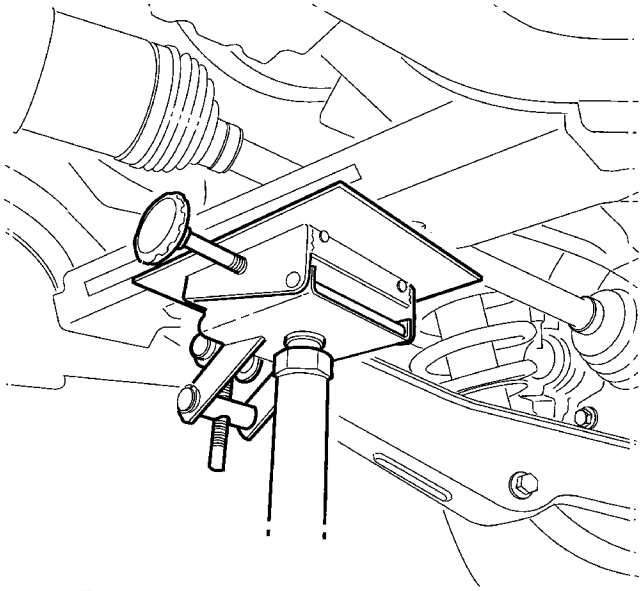
8. Release the worm drive hose clamp (1) and remove the filler tube (2).



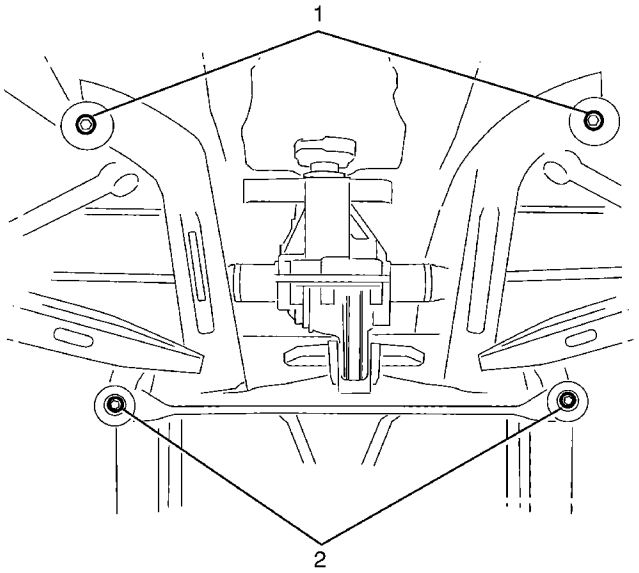
9. Disconnect the fuel feed line (1) and EVAP line (2). Refer to Plastic Collar Quick Connect Fitting Service.



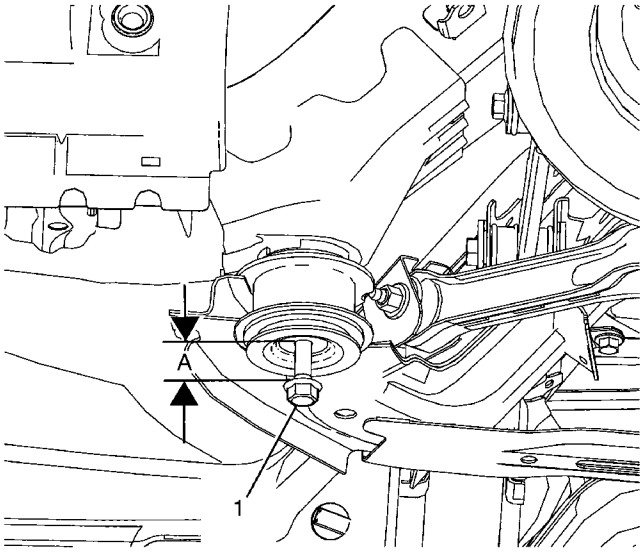
10. Disconnect the fuel tank electrical connector (1).



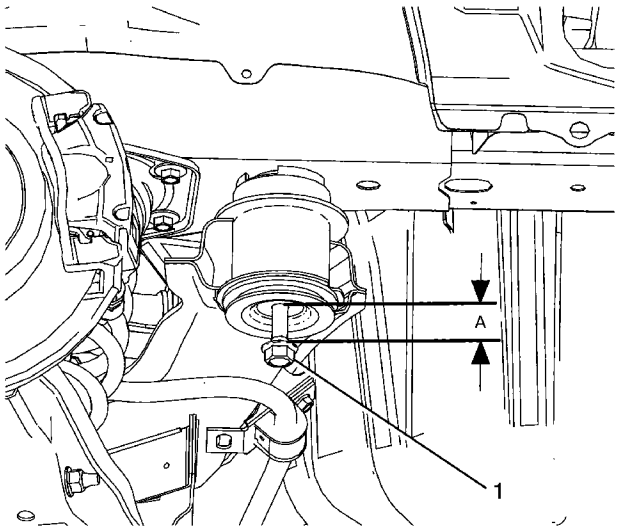
11. Support the rear frame assembly using a suitable tool.



12. Remove the rear frame to chassis retaining bolts (1) and (2) and discard.

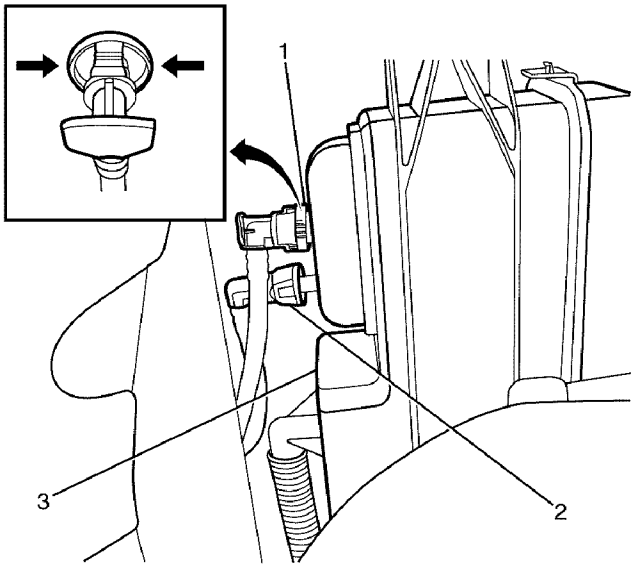


13. Support the rear frame using the bolt (1) from the EN-48536 special tool kit. Repeat for the opposite side.

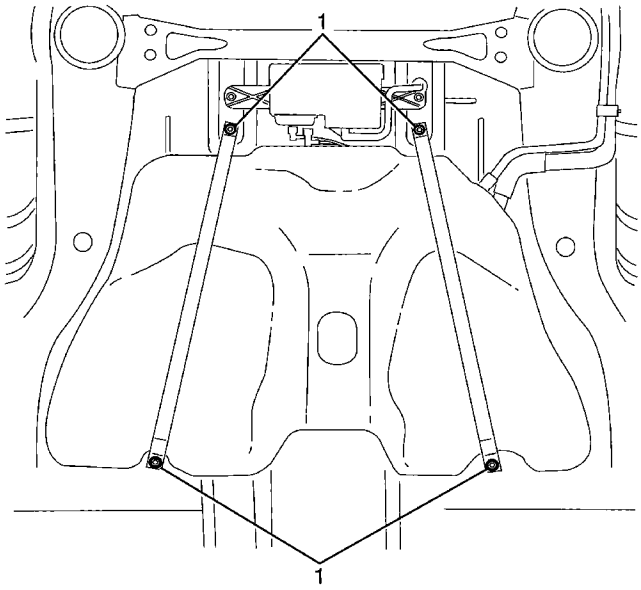


Note: When lowering the rear frame use care not to over extend the rear brake hoses.

14. Support the rear frame using the bolt (1) from the EN-48536 special tool kit. Repeat for the opposite side.
15. Lower the rear frame approximately 50 millimeters (2 in) (A) at the rear mounting surface between the rear frame and the chassis.
16. This will allow clearance to access the fuel tank strap bolts.
17. Remove the fuel tank heat shield. Refer to Fuel Tank Heat Shield Replacement.
18. Disconnect the park brake rear cables from the park brake front cable equalizer bracket assembly. Refer to Parking Brake Front Cable Replacement.



19. Disconnect the EVAP line (2) from the EVAP canister (3). Refer to Plastic Collar Quick Connect Fitting Service.



20. Remove the fuel tank strap to chassis retaining bolts (1).
21. Position the fuel tank straps away from the fuel tank.
22. Carefully bend the fuel tank straps enough to allow the fuel tank to be removed.

Note: Make sure the following are free from the surrounding components while lowering the fuel tank:

- The fuel tank wiring harness
- The fuel hoses at the chassis pipes

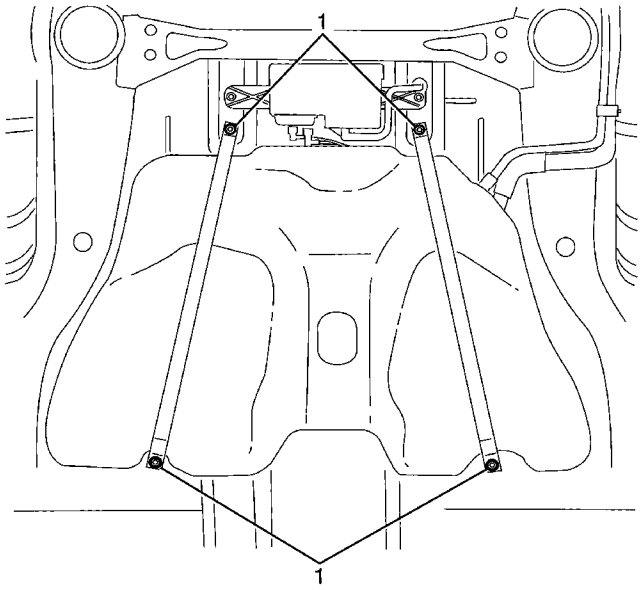
23. With the aid of an assistant, carefully lower the fuel tank from the vehicle.
24. Remove the following components if replacing just the fuel tank:
    - The primary fuel tank module--Refer to Primary Fuel Tank Module Replacement.
    - The secondary fuel tank module--Refer to Secondary Fuel Tank Module Replacement.

Installation Procedure

1. Install the following components if fuel tank replacement was necessary:
    - The primary fuel tank module--Refer to Primary Fuel Tank Module Replacement.
    - The secondary fuel tank module--Refer to Secondary Fuel Tank Module Replacement.

Note: Make sure the following are properly routed while raising the fuel tank:

- The fuel tank wiring harness
- The fuel hoses at the chassis pipes



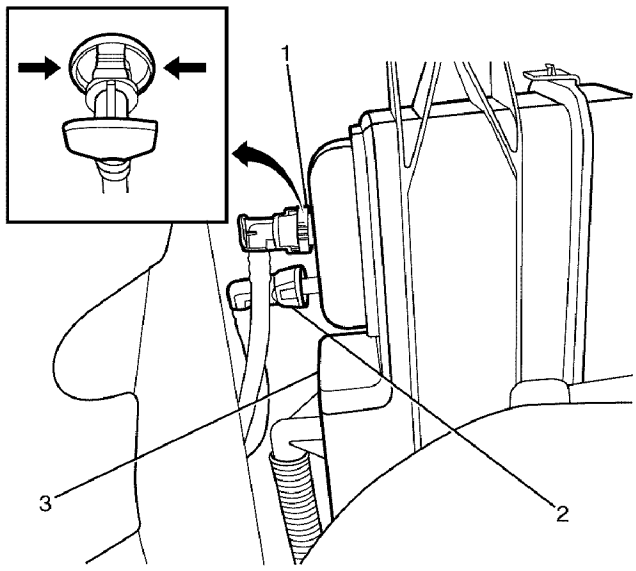
2. With the aid of an assistant, carefully raise the fuel tank to the vehicle.

Note: Make sure the fuel tank straps are not pressed into the fuel tank.

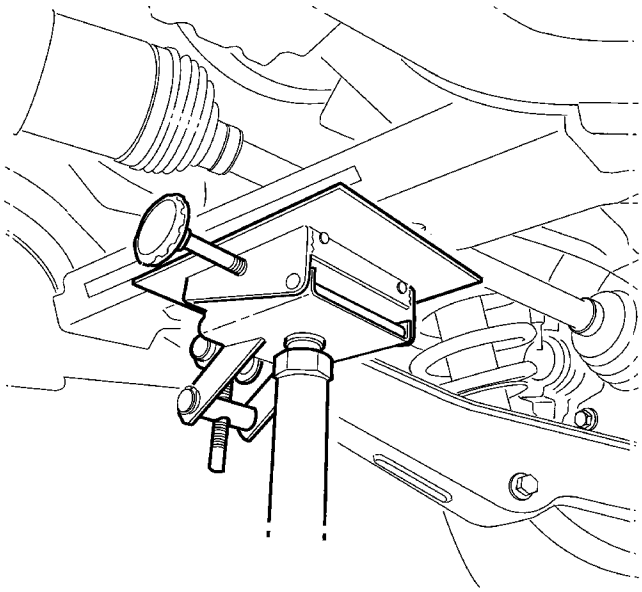
3. Carefully install the fuel tank straps back to their original form.
4. Position the fuel tank straps around the rear frame and upward into position, aligning the holes in the straps with the threaded holes in the chassis.

Caution: Refer to Fastener Caution in the Preface section.

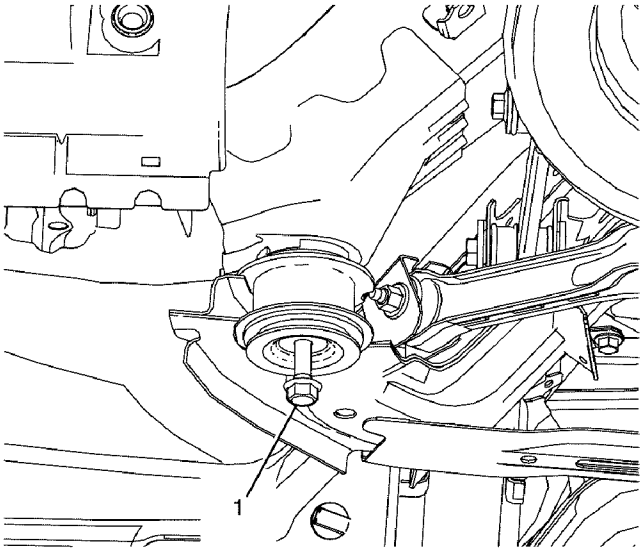
5. Install the fuel tank strap bolts and tighten to **20 N·m (15 lb ft)**.



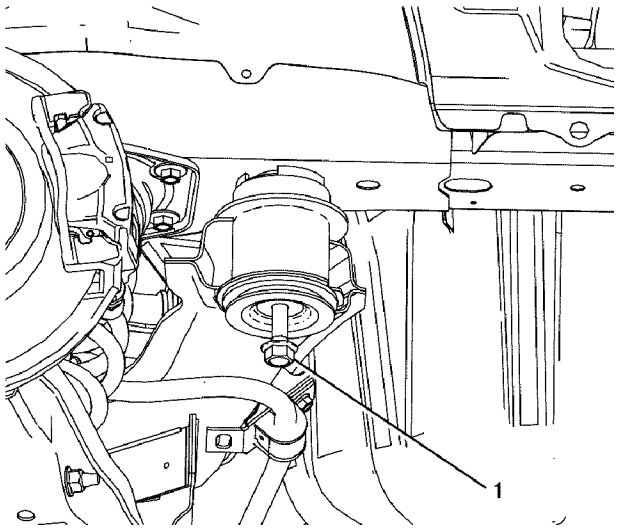
6. Connect the EVAP line (2) to the EVAP canister (3). Refer to Plastic Collar Quick Connect Fitting Service.



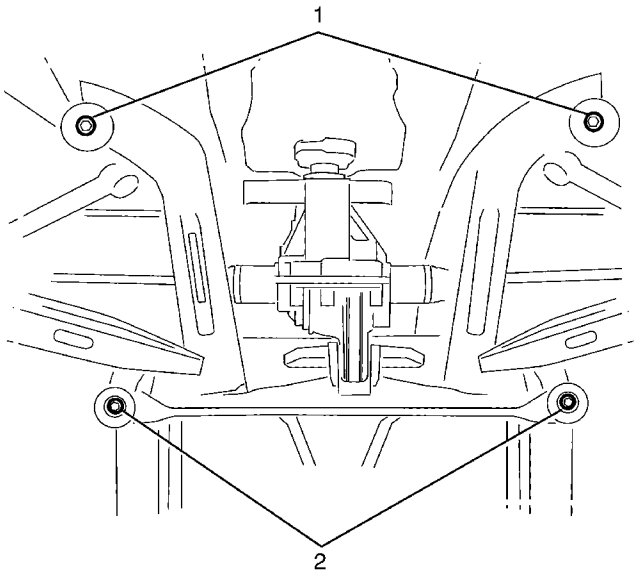
7. Raise the rear frame assembly using suitable tool.



8. Remove the special tool EN-48536 bolt (1) from the rear frame. Repeat for the opposite side.



9. Remove the special tool EN-48536 bolt (1) from the rear frame. Repeat for the opposite side.
10. Using a suitable tool, clean the threaded holes in the rear chassis.

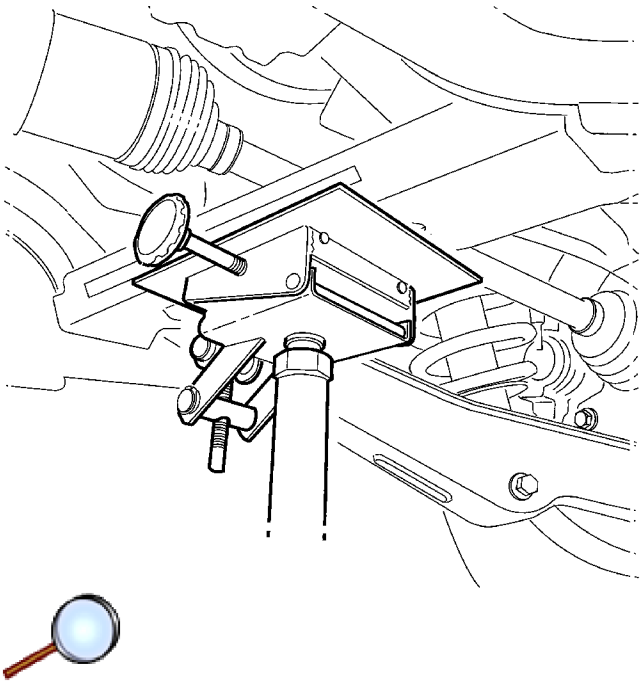


Note: Rear frame retaining bolts must not to be fully tightened at this stage.

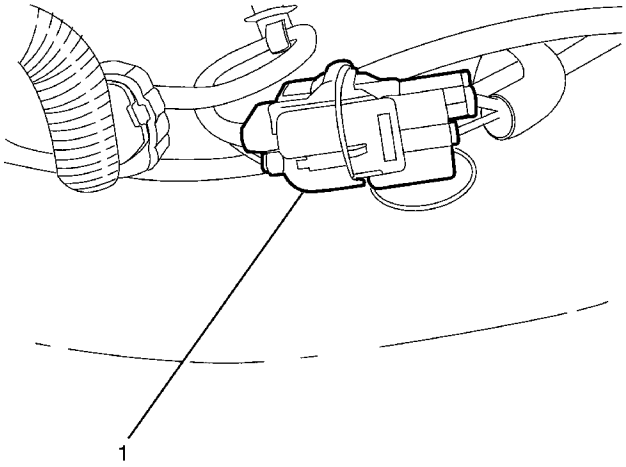
11. Install the NEW rear frame to chassis retaining bolts (2).

    Do not fully tighten at this stage.

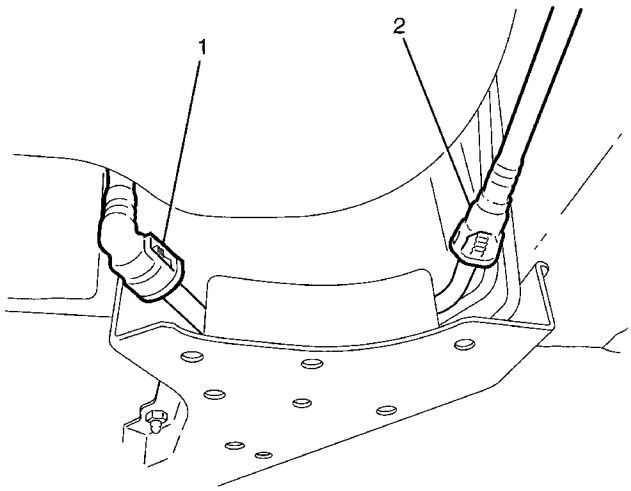
12. After retaining bolts (1 and 2) are installed, tighten a first pass to **65 N·m (48 lb ft)** and a final pass to **125 degrees**.



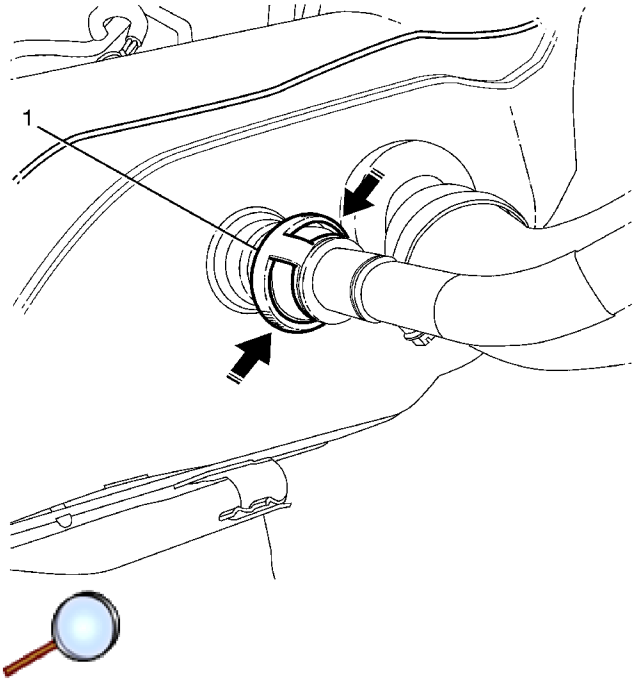
13. Remove the support tool.



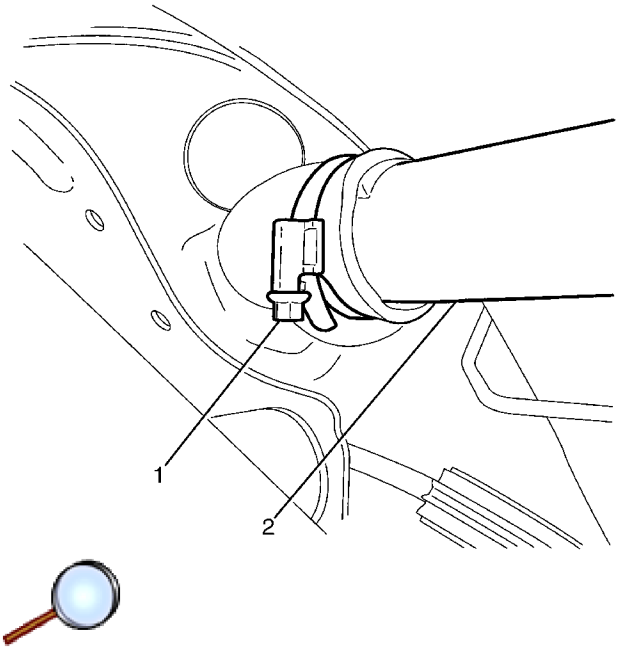
14. Connect the fuel tank electrical connector (1).



15. Refer to Plastic Collar Quick Connect Fitting Service in order to connect the following to the chassis bundle:
    - The fuel feed line
    - The fuel EVAP hose

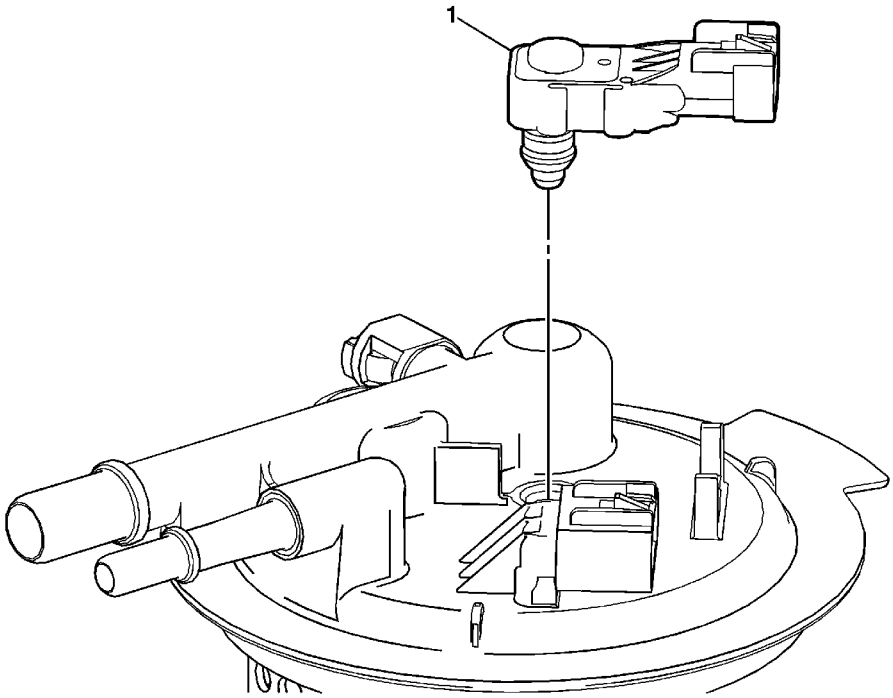


16. Install the evaporative emission (EVAP) line (1). Listen for an audible click to confirm fitting.



17. Connect the filler hose (2) to the fuel tank and tighten the clamp (1) to **4 N·m (35 lb in)**.
18. Connect the park brake rear cables to the park brake front cable equalizer bracket assembly. Refer to Parking Brake Front Cable Replacement.
19. Install the propeller shaft. Refer to Propeller Shaft Replacement.
20. Install the exhaust system. Refer to Exhaust System Replacement.
21. Install the right rear wheel. Refer to Tire and Wheel Removal and Installation.
22. Refill the fuel tank.
23. Inspect for fuel leaks.

Fuel Tank Pressure Sensor Replacement



Callout	Component Name
Preliminary Procedure Remove the fuel tank. Refer to Fuel Tank Replacement.	
1	Fuel Tank Pressure Sensor **Procedure** Disconnect the electrical connector.

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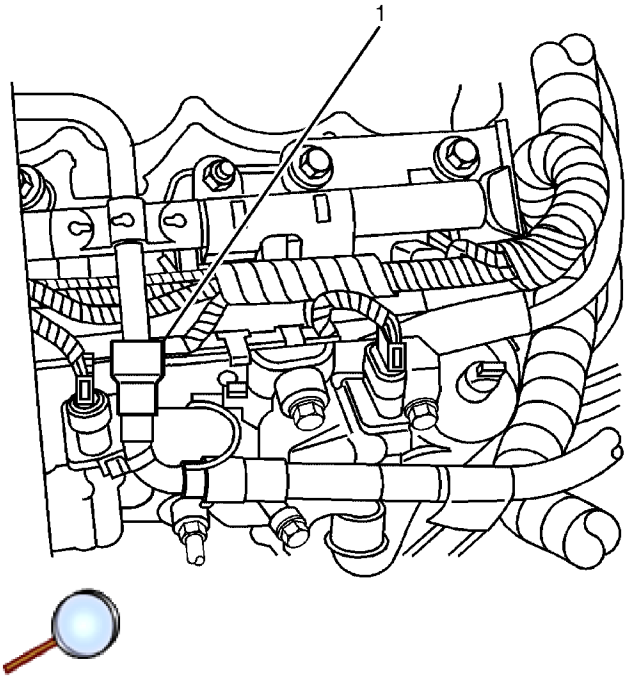
Fuel Hose/Pipes Replacement - Engine Compartment

Removal Procedure

Caution: Clean all of the following areas before performing any disconnections in order to avoid possible contamination in the system:

- The fuel pipe connections
- The hose connections
- The areas surrounding the connections

1. Remove the engine cover. Refer to Engine Cover Replacement.
2. Relieve the fuel system pressure. Refer to Fuel Pressure Relief.
3. Loosen the fuel filler cap to relieve any vapor pressure.
4. Disconnect the negative battery cable. Refer to Battery Negative Cable Disconnection and Connection.



5. Disconnect the engine compartment fuel feed pipe (1) at the fuel rail. Refer to Metal Collar Quick Connect Fitting Service.

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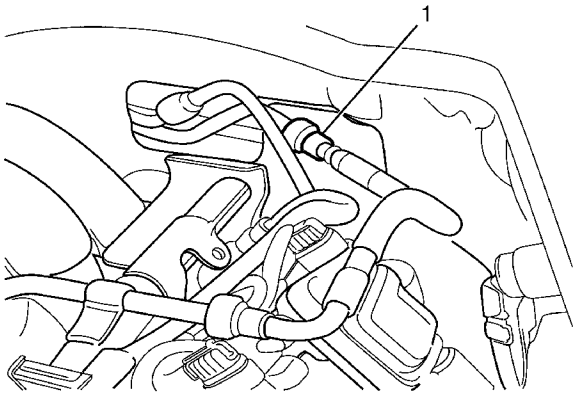
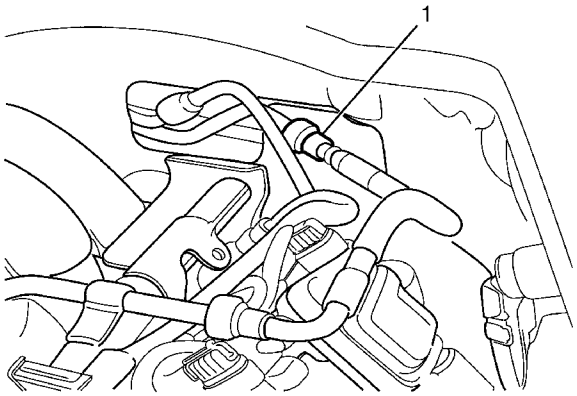
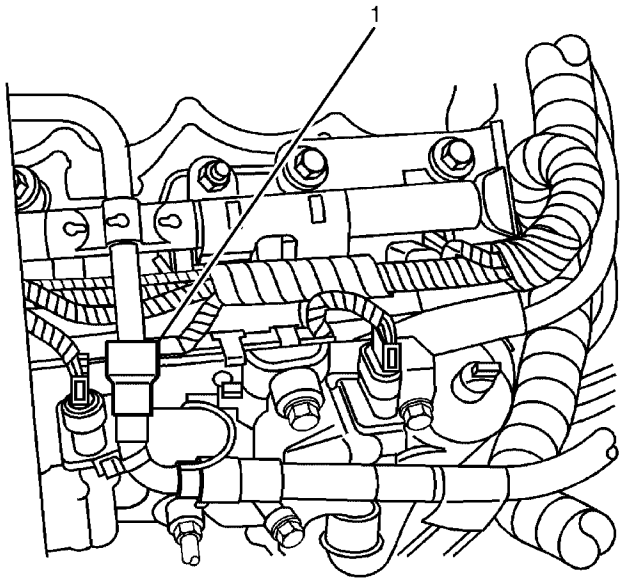


6. Disconnect the fuel feed pipe (1) from the fuel feed line. Refer to Metal Collar Quick Connect Fitting Service.
7. Cap the fuel pipe to prevent possible fuel system contamination.

Installation Procedure



1. Connect the fuel feed pipe (1) from the fuel feed line. Refer to Metal Collar Quick Connect Fitting Service.



2. Install the engine compartment fuel feed pipe (1) at the fuel rail. Refer to Metal Collar Quick Connect Fitting Service.
3. Install the fuel filler cap.
4. Connect the negative battery cable. Refer to Battery Negative Cable Disconnection and Connection.
   4.1. Turn ON the ignition for 2 seconds.
   4.2. Turn OFF the ignition for 2 seconds.
   4.3. Turn ON the ignition.
   4.4. Inspect for fuel leaks.
5. Install the engine cover. Refer to Engine Cover Replacement.

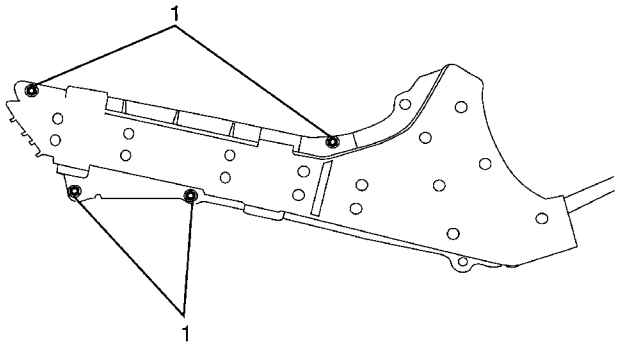
Fuel Hose / Pipes Replacement - Chassis

Removal Procedure

Danger: To avoid any vehicle damage, serious personal injury or death when major components are removed from the vehicle and the vehicle is supported by a hoist, support the vehicle with jack stands at the opposite end from which the components are being removed and strap the vehicle to the hoist.

Note: The fuel system hose/pipes are serviceable individually or as a complete fuel/brake bundle assembly. The following procedure is servicing the fuel hose/pipes individually.

1. Disconnect the negative battery cable. Refer to Battery Negative Cable Disconnection and Connection.
2. Before you service any fuel system connection, relieve the fuel system pressure. Refer to the Fuel Pressure Relief.
3. Remove the exhaust and exhaust heat shields. Refer to Exhaust System Replacement.
4. Remove the engine. Refer to Engine Replacement.
5. Disconnect the fuel and evaporative emission (EVAP) lines at the fuel tank. Refer to Fuel Tank Replacement.
6. Disconnect the fuel and EVAP) lines at the engine compartment.



7. Remove the retaining bolts (1) and the retaining nuts (1) securing the rear stone guard.

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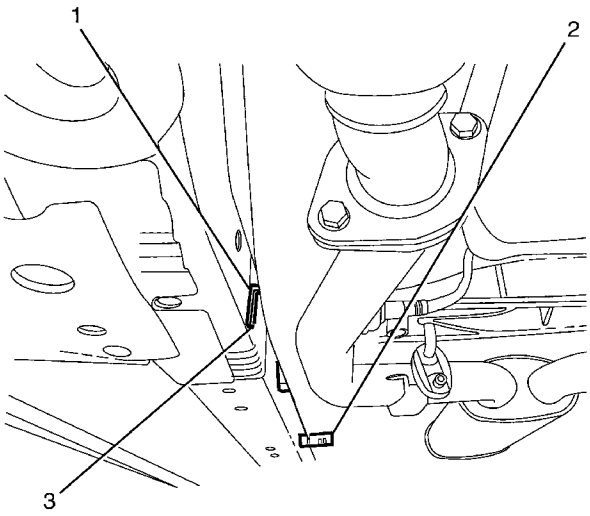
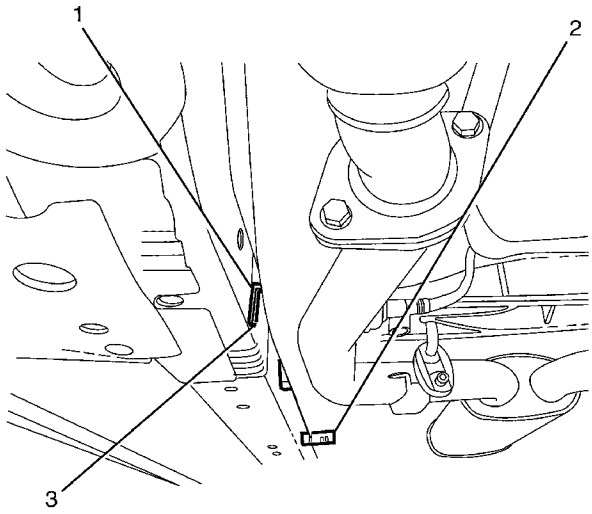
8. Remove all the fuel line bracket pop rivets securing the fuel and EVAP pipes to the vehicle body.



9. Remove all the fuel line bracket pop rivets (1, 2, 3) securing the fuel and EVAP pipes to the body tunnel.
10. Remove the fuel and EVAP lines from the vehicle.

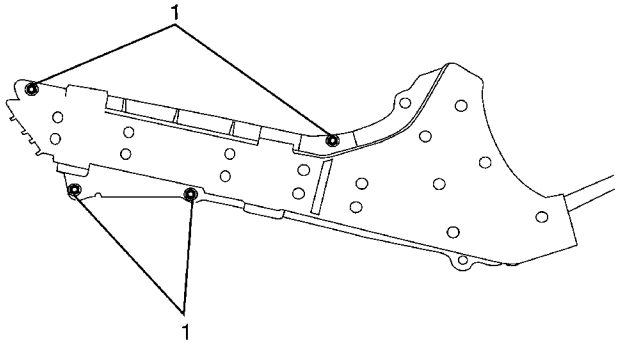
Installation Procedure

1. Install the fuel and EVAP lines to the vehicle.



2. Install all the fuel line bracket pop rivets (1, 2, 3) securing the fuel and EVAP pipes to the body tunnel.

3. Install all the fuel line bracket pop rivets securing the fuel and EVAP pipes to the vehicle body.



4. Install the retaining bolts (1) and the retaining nuts (1) securing the rear stone guard.
5. Connect the fuel and EVAP lines at the engine compartment.
6. Connect the fuel and EVAP lines at the fuel tank. Refer to Fuel Tank Replacement.
7. Install the engine. Refer to Engine Replacement.
8. Install the exhaust and exhaust heat shields. Refer to Exhaust System Replacement.
9. Connect the negative battery cable. Refer to Battery Negative Cable Disconnection and Connection.

Fuel System Cleaning

Special Tools

- J 45722 Fuel Sender Lock Ring Wrench
- CH-48482 Fuel Sender Lock Ring Wrench
- J 45004 Fuel Tank Drain Hose

Warning: Refer to Gasoline/Gasoline Vapors Warning in the Preface section.

Note:

- The following procedure covers the disassembly and the inspection of the complete fuel supply system. If the fuel system is contaminated, the fuel system can be cleaned. You can usually determine the extent of the fuel system contamination during the disassembly.
- If the fuel filter is plugged, the fuel tank should be inspected internally and cleaned if necessary.

1. Remove the fuel tank. Refer to Fuel Tank Draining.
2. Remove the fuel module assemblies. Refer to Primary Fuel Tank Module Replacement and Secondary Fuel Tank Module Replacement.
3. Locate the tank in a suitable work area away from any heat, any flame, or any other source of ignition.
4. Perform the following procedures:
   - Inspect the fuel sender strainer. Replace the primary fuel tank module if the strainer is contaminated.
   - Inspect the secondary fuel tank module for debris. Clean the secondary fuel tank module if debris is found.

     Warning: Wear safety glasses when using compressed air, as flying dirt particles may cause eye injury.

     Note: Only use oil-free compressed air to blow out the fuel pipes.

   - Use compressed air in order to apply air pressure to the transfer tube.

   Note: When flushing the fuel tank, handle the fuel and water mixture as a hazardous material. Handle the fuel and water in accordance with all applicable local, state, and federal laws and regulations.

5. Flush the fuel tank with running hot water for at least 5 minutes. Pour the water out of the fuel sender assembly opening. Rock the tank in order to make sure that the removal of the water from the tank is complete.
6. Refer to Metal Collar Quick Connect Fitting Service to disconnect the following quick connect fittings from the fuel rail:

   The feed hose/pipe

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Note: Only use oil-free compressed air to blow out the fuel pipes.

7. Use compressed air in order to apply air pressure to the fuel lines in the opposite direction from the normal fuel flow.
8. Remove the fuel injectors and fuel rail. Refer to Fuel Injection Fuel Rail Assembly Replacement.
9. Clean and inspect the fuel injectors and fuel rail.

Installation Procedure

1. Assemble the fuel system as follows:

   Install the fuel injectors and fuel rail. Refer to Fuel Injection Fuel Rail Assembly Replacement.

2. Install the fuel module assemblies. Refer to Primary Fuel Tank Module Replacement and Secondary Fuel Tank Module Replacement.
3. Refer to Metal Collar Quick Connect Fitting Service to connect the following quick connect fittings to the fuel rail:

   The feed hose/pipe

4. Install the fuel tank. Refer to Fuel Tank Replacement.

Fuel Injection Fuel Rail Assembly Replacement

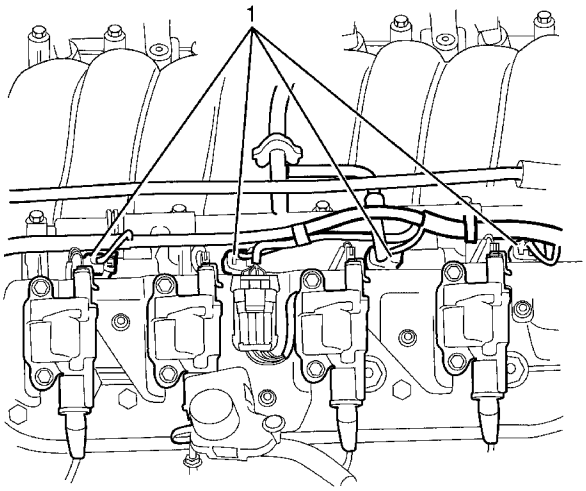
Removal Procedure

1. Relieve the fuel system pressure. Refer to the Fuel Pressure Relief.
2. Before removal, clean the fuel rail assembly with a spray type engine cleaner, if necessary. Follow the package instructions. Do not soak fuel rails in liquid cleaning solvent.

Caution:

- Remove the fuel rail assembly carefully in order to prevent damage to the injector electrical connector terminals and the injector spray tips. Support the fuel rail after the fuel rail is removed in order to avoid damaging the fuel rail components.
- Cap the fittings and plug the holes when servicing the fuel system in order to prevent dirt and other contaminants from entering open pipes and passages.

3. Disconnect the fuel feed hose from the fuel rail. Refer to Metal Collar Quick Connect Fitting Service.



Note: Identify the connectors to their corresponding injectors to make sure correct sequential injector firing order after reassembly.

4. Disconnect the injector electrical connectors (2) to the injectors.

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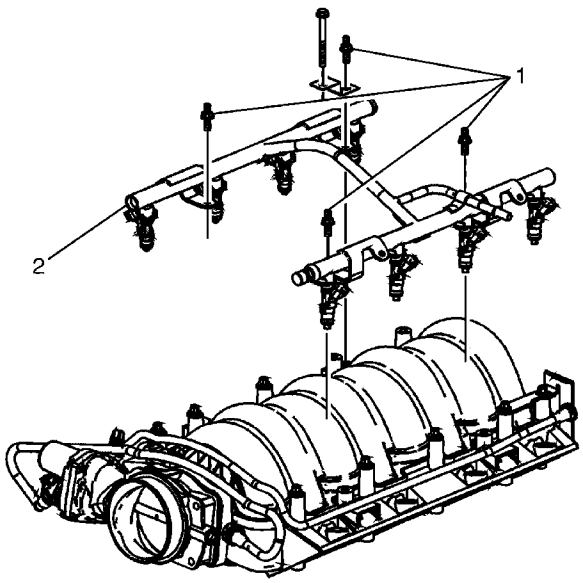
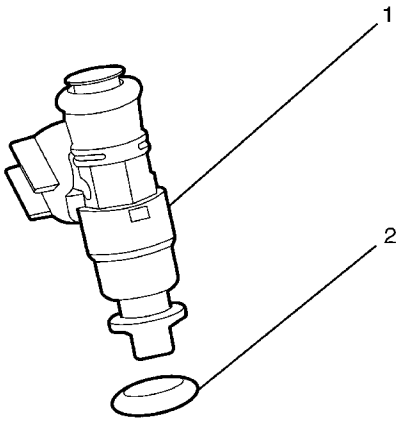


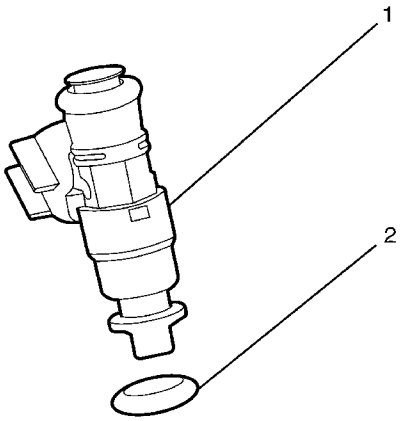
5. Disconnect the electrical harness from the fuel rail brackets.
6. Remove the fuel rail ground strap to intake manifold retaining bolt (1).
7. Remove the fuel rail to intake manifold retaining bolts (2).
8. Lift evenly on both sides of the fuel rail , and remove the fuel rail assembly.



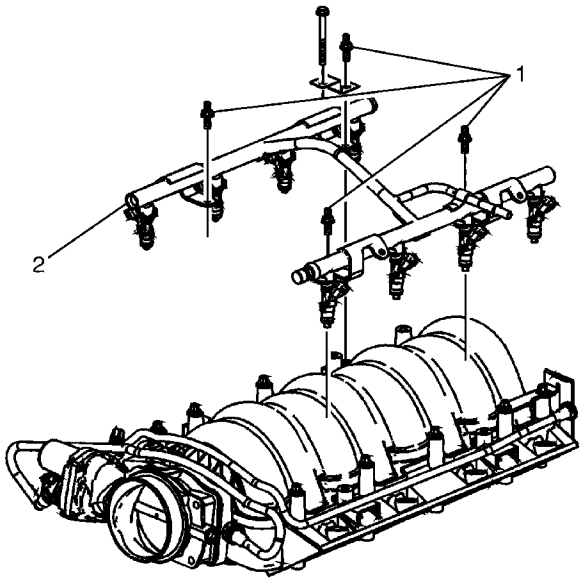
9. Remove the injector lower O-ring seal (2) from the spray tip end of each injector and discard.

   Discard the O-ring seals.

Installation Procedure



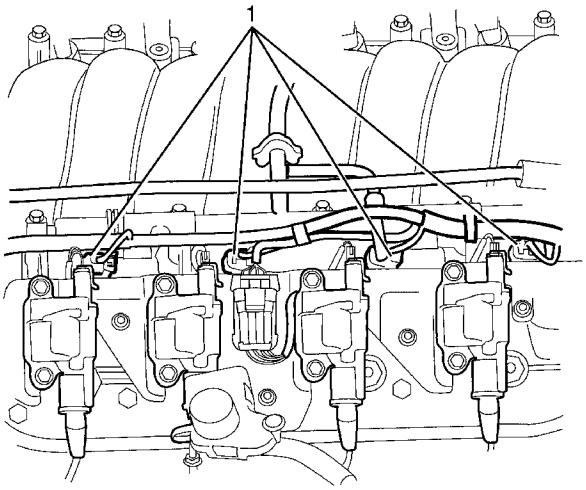
1. Lubricate the NEW lower injector O-ring seals (2) with clean engine oil.
2. Install the new O-ring seals (2) on the spray tip end of each injector.



3. Install the fuel rail assembly to the intake manifold.
4. Apply a 0.5 mm (0.02 in) band of approved threadlock to the threads of the fuel rail retaining bolts.

Caution: Refer to Fastener Caution in the Preface section.

5. Install the fuel rail to intake manifold retaining bolts (2) and tighten to **10 N·m (89 lb in)**.
6. Install the fuel rail ground strap to intake manifold retaining bolts (1) and tighten to **10 N·m (89 lb in)**.

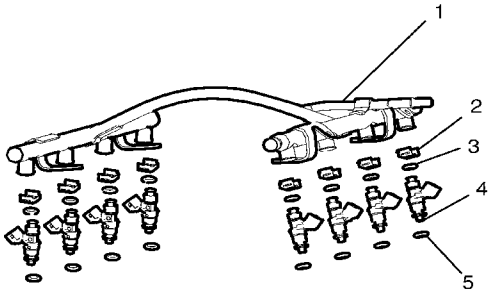


7. Connect the injector electrical connectors (1) to the injectors.
   - Install each connector on the proper injector in order to make sure correct sequential injector firing order.
   - Rotate the injectors as required in order to avoid stretching the wire harness.
8. Connect the electrical harness to the fuel rail brackets.
9. Connect the fuel feed hose to the fuel rail fuel pipe. Refer to Metal Collar Quick Connect Fitting Service.
10. Connect the negative battery cable.
11. Inspect for leaks.
    11.1. Turn ON the ignition for 2 seconds.
    11.2. Turn OFF the ignition for 10 seconds.
    11.3. Turn ON the ignition.
    11.4. Inspect for fuel leaks.

Fuel Injector Replacement

Removal Procedure

1. Remove the fuel rail assembly. Refer to Fuel Injection Fuel Rail Assembly Replacement.



2. Remove the fuel injector to fuel rail assembly retaining clips (2).

   Caution: Use care in removing the fuel injectors in order to prevent damage to the fuel injector electrical connector pins or the fuel injector nozzles. Do not immerse the fuel injector in any type of cleaner. The fuel injector is an electrical component and may be damaged by this cleaning method.

3. Remove the fuel injector (4) from the fuel rail (1).
4. Remove the injector lower O-ring seal (5) from the spray tip end of each injector and discard.

   Discard the O-ring seals.

5. Remove the injector upper O-ring seal (3) from the fuel rail end of each injector and discard.

   Discard the O-ring seals.

Installation Procedure

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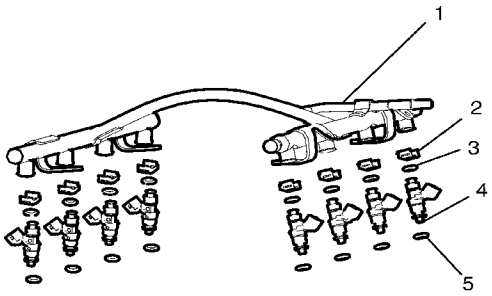


1. Apply a small amount of clean motor oil to the O-rings (3) and (5), before installing the new fuel injector.
2. Install the NEW injector upper O-ring seals (3) to the injectors.
3. Install the NEW injector lower O-ring seals (5) to the injectors.
4. Install the fuel injector (4) in the fuel rail (1).
5. Install the retaining clips for the fuel injector (3).
6. Install the fuel rail assembly. Refer to Fuel Injection Fuel Rail Assembly Replacement.
   - 6.1. Turn the ignition switch ON for 2 seconds.
   - 6.2. Turn the ignition switch OFF for 10 seconds.
   - 6.3. Turn the ignition switch ON.
   - 6.4. Inspect for fuel leaks.

Fuel Injector Cleaning

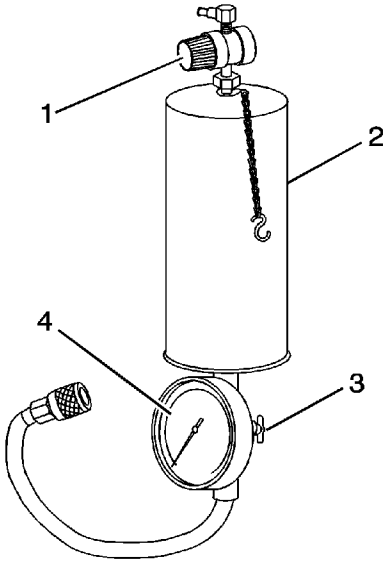
Special Tools

- J 37287 Fuel Line Shut-Off Adapters
- J 35800-A Fuel Injector Cleaner
- J 42873-1 3/8 Fuel Line Shut-Off Valve
- J 42873-2 5/16 Return Pipe Shut-Off Valve
- J 42964-1 3/8 Fuel Pipe Shut-Off Valve
- J 42964-2 5/16 Fuel Pipe Shut-Off Valve

Caution:

- GM Upper Engine and Fuel Injector Cleaner is the only injector cleaning agent recommended. DO NOT USE OTHER CLEANING AGENTS AS THEY MAY CONTAIN METHANOL, WHICH CAN DAMAGE FUEL SYSTEM COMPONENTS.
- Under NO circumstances should the GM Upper Engine and Fuel Injector Cleaner be added to the vehicle fuel tank, as it may damage the fuel pump and other system components.
- Do not exceed the recommended cleaning solution concentration. Higher concentrations may damage fuel system components. Testing has demonstrated that exceeding the recommended cleaning solution concentration does not improve the effectiveness of this procedure.

Note: Vehicles with less than 160 km (100 mi) on the odometer should not have the injectors cleaned. These vehicles should have the injectors replaced.



1. Obtain J 35800-A (2).

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Note: Make sure the valve at the bottom of the canister (3) is closed.

2. For 4, 5, and 6 cylinder engines, empty 2 of the 30 ml (1 oz) reservoirs of the GM Upper Engine and Fuel Injector Cleaner twin reservoir container into the J 35800-A , injector cleaning tank, then add 420 ml (14 oz) of regular unleaded gasoline. If you are using any other brand of cleaning tank, you will need a total of 60 ml (2 oz) of GM Upper Engine and Fuel Injector Cleaner mixed with 420 ml (14 oz) of regular unleaded gasoline.
3. For 8 cylinder engines, empty 2 of the 30 ml (1 oz) reservoirs of the GM Upper Engine and Fuel Injector Cleaner twin reservoir container into the J 35800-A , injector cleaning tank, then add 420 ml (14 oz) of regular unleaded gasoline. If you are using any other brand of cleaning tank, you will need a total of 60 ml (2 oz) of GM Upper Engine and Fuel Injector Cleaner mixed with 420 ml (14 oz) of regular unleaded gasoline.

   This procedure will need to be repeated for an 8 cylinder engine. The 8 cylinder engines receive 960 ml total fluid--120 ml (4 oz) of GM Upper Engine and Fuel Injector Cleaner and 840 ml (28 oz) of gasoline.

4. Fill the injector cleaning tank with regular unleaded gasoline. Be sure to follow all additional instructions provided with the tool.
5. Electrically disable the vehicle fuel pump by removing the fuel pump relay and disconnecting the oil pressure switch connector, if equipped.
6. Disconnect the fuel feed and return line, if equipped, at the fuel rail. Plug the fuel feed and return line, if equipped, coming off the fuel rail with J 37287 , or J 42964-1 , and J 42964-2 or J 42873-1 , and J 42873-2 as appropriate for the fuel system.
7. Connect the J 35800-A to the vehicle fuel rail.
8. Pressurize the J 35800-A to 510 kPa (75 psi).
9. Start and idle the engine until it stalls due to lack of fuel. This should take approximately 15-20 minutes.
10. Turn the ignition to the OFF position.
11. Injectors should be flow-tested at this point. If further cleaning is needed, a repeat of the above procedure should be done.

    When the injector restriction returns to zero, proceed to step 12.

12. Disconnect the J 35800-A from the fuel rail.
13. Reconnect the vehicle fuel pump relay and oil pressure switch connector, if equipped.
14. Remove the J 37287 , or J 42964-1 and J 42964-2 , or J 42873-1 and J 42873-2 and reconnect the vehicle fuel feed and return lines.
15. Start and idle the vehicle for an additional two minutes to ensure residual injector cleaner is flushed from the fuel rail and fuel lines.
16. Pour the entire contents of GM Fuel System Treatment Plus, GM P/N 88861011 (Canadian P/N 88861012) into a nearly empty tank and advise the customer to refuel with up to 76 L (20 gal) of fuel.
17. Advise the customer to use only a Top Tier Detergent gasoline and to add a bottle of GM Fuel System Treatment Plus to the fuel tank at every oil change.

    Regular use of GM Fuel System Treatment Plus should keep the customer from having to repeat the injector cleaning procedure.

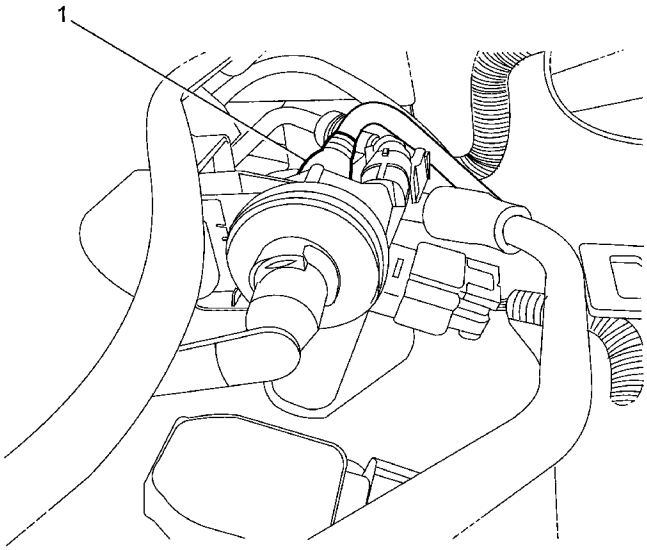
18. Road test the vehicle to verify that the customer concern has been corrected.

Evaporative Emission Canister Purge Solenoid Valve Replacement

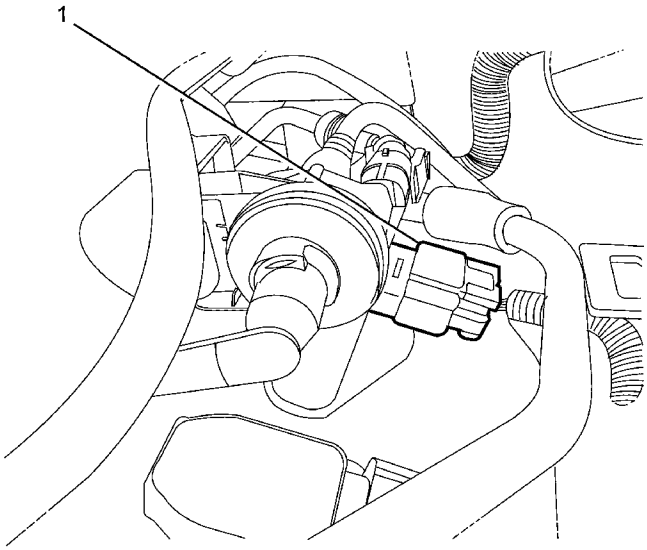
Removal Procedure

Warning: Refer to Safety Glasses Warning in the Preface section.

1. Turn the ignition OFF.



2. Disconnect the purge line (1) from the purge valve solenoid.



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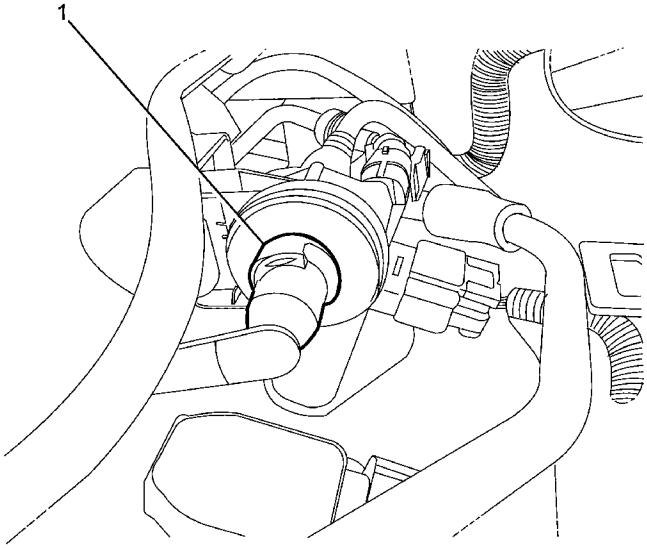
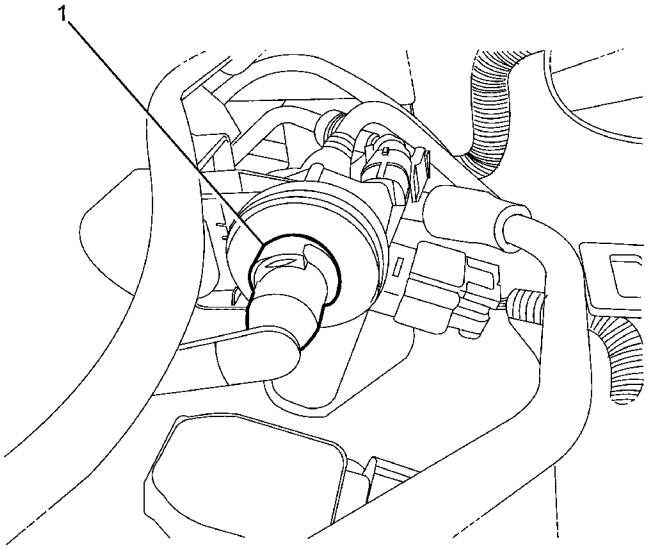
3. Disconnect the purge valve solenoid electrical connector (1).

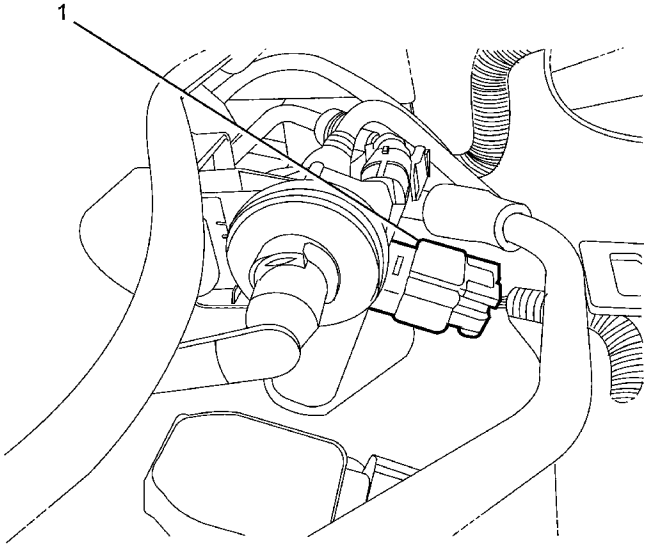


4. Disconnect the purge line (1) from the manifold side of the purge valve solenoid.
5. Remove the purge valve solenoid.

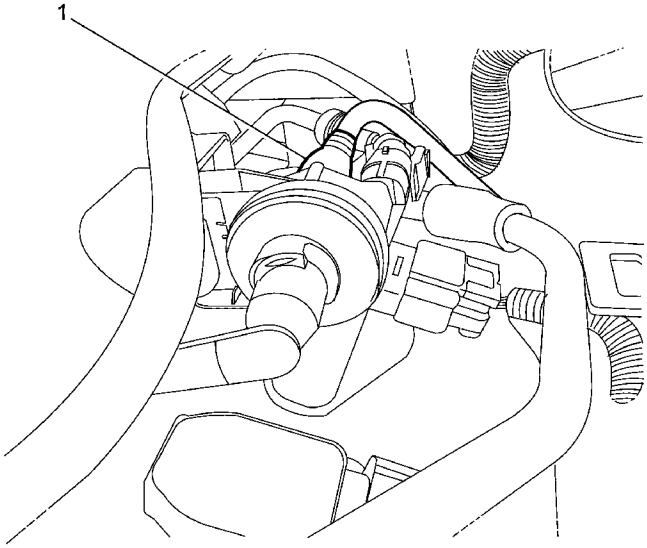
Installation Procedure



1. Install the purge valve solenoid.
2. Connect the purge line (1) from the manifold side of the purge valve solenoid.



3. Connect the purge valve solenoid electrical connector.



4. Connect the purge line (1) to the purge valve solenoid.

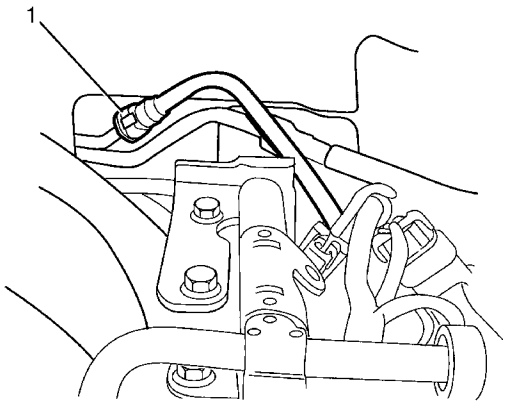
Evaporative Emission Hoses/Pipes Replacement - Engine

Removal Procedure

Caution: Clean all of the following areas before performing any disconnections in order to avoid possible contamination in the system:

- The fuel pipe connections
- The hose connections
- The areas surrounding the connections

1. Loosen the fuel filler cap to relieve any vapor pressure.
2. Disconnect the negative battery cable.
3. Remove the engine cover. Refer to Engine Cover Replacement.



4. Disconnect the evaporative emission (EVAP) engine tube (1) from the EVAP chassis pipe. Refer to Plastic Collar Quick Connect Fitting Service.

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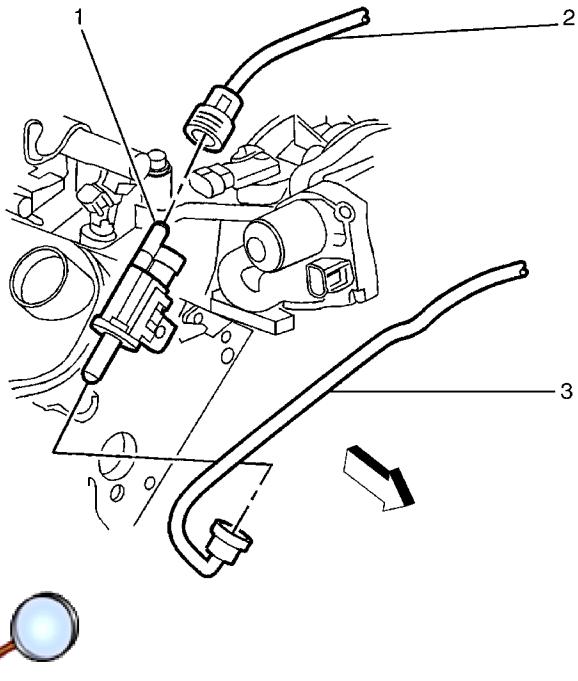
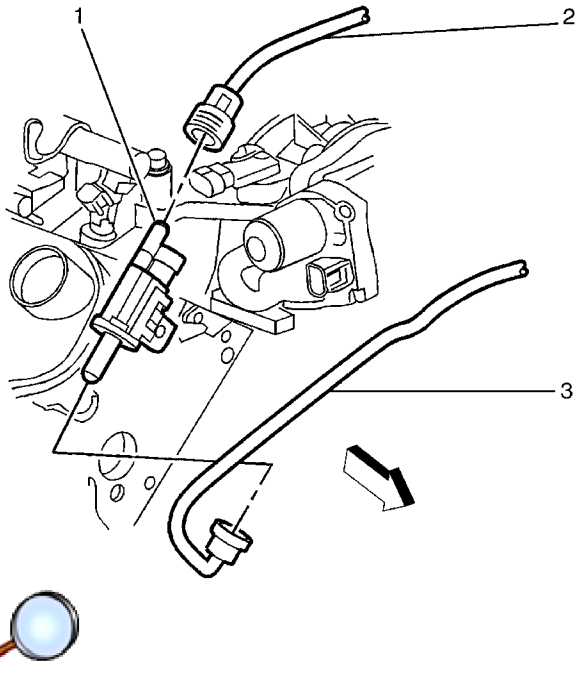
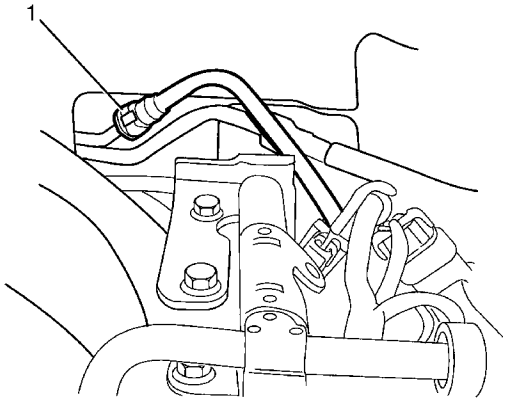


5. Disconnect the EVAP engine tube (2) from the EVAP valve solenoid. Refer to Plastic Collar Quick Connect Fitting Service.
6. Remove the EVAP engine tube (2) from the engine compartment.

Installation Procedure



1. Install the EVAP engine tube (2) to the EVAP valve solenoid. Refer to Plastic Collar Quick Connect Fitting Service.



2. Connect the EVAP engine tube (1) to the EVAP chassis pipe. Refer to Plastic Collar Quick Connect Fitting Service.
3. Install the oil filler cap.
4. Connect the negative battery cable.
5. Install the engine cover. Refer to Engine Cover Replacement.

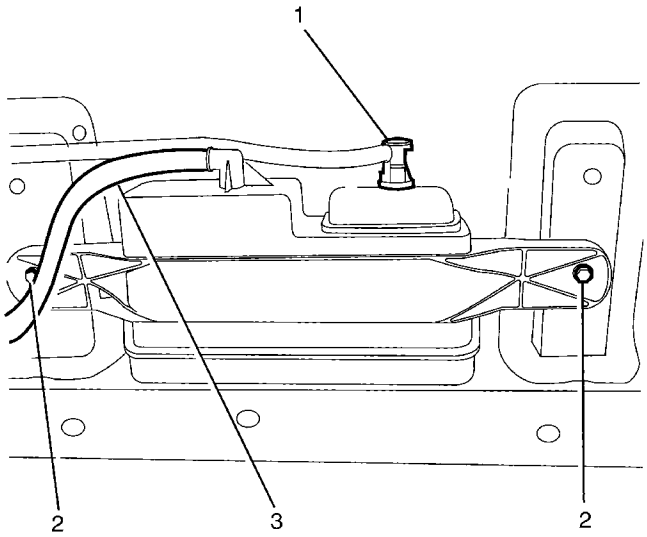
Evaporative Emission Canister Replacement

Removal Procedure

Warning: Refer to Safety Glasses Warning in the Preface section.

Danger: To avoid any vehicle damage, serious personal injury or death when major components are removed from the vehicle and the vehicle is supported by a hoist, support the vehicle with jack stands at the opposite end from which the components are being removed and strap the vehicle to the hoist.

1. Raise the vehicle. Refer to Lifting and Jacking the Vehicle.
2. Remove the rear frame. Refer to Rear Frame Replacement.



3. Disconnect the canister purge tube (1) from the canister.
4. Remove the canister vent tube (3) from the canister by twisting and pulling it away from the canister.
5. Remove the canister to under body retaining bolts (2).
6. Remove the evaporative emission canister from the vehicle.

Installation Procedure

1. Install the evaporative emission (EVAP) canister to the vehicle.

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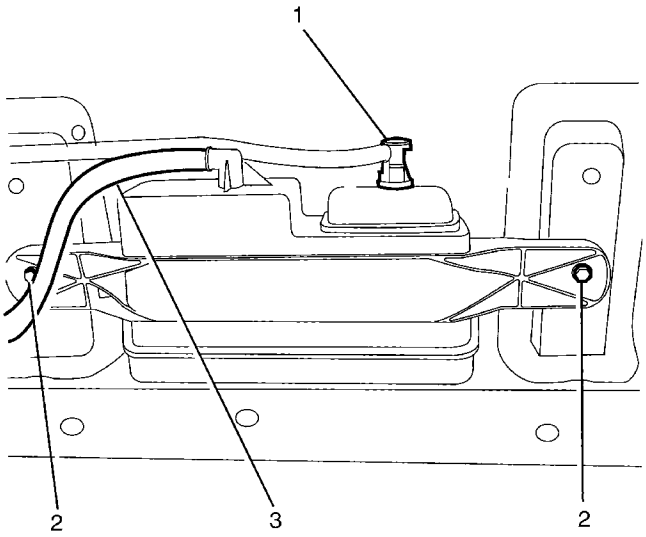


2. Install the EVAP canister retaining bolts (2). Hand tighten only.

Caution: Refer to Fastener Caution in the Preface section.

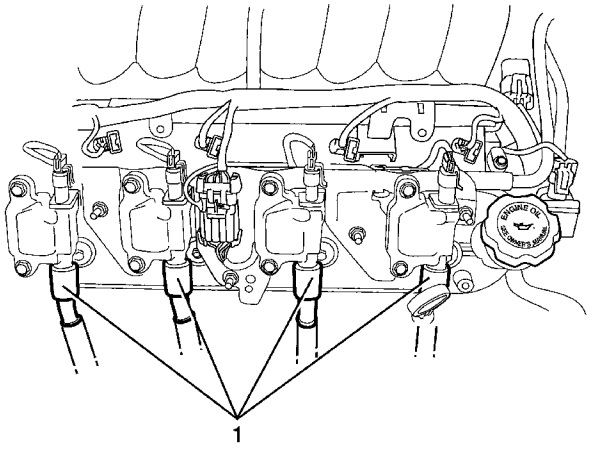
3. Tighten the EVAP canister to vehicle retaining bolts and tighten to **6 N·m (53 lb in)**.
4. Install the canister vent pipe (3) to the canister vent port.
5. Align the canister purge pipe quick connector (1) with the canister purge pipe port and push the connector firmly onto the port.
6. Install the rear frame. Refer to Rear Frame Replacement.
7. Lower the vehicle.

Ignition Coil Replacement

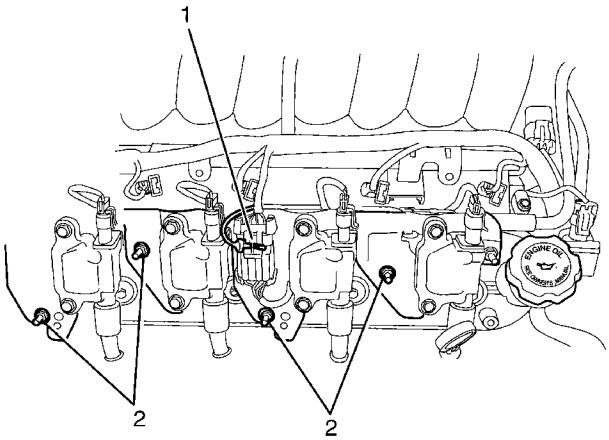
Removal Procedure

Warning: Refer to Battery Disconnect Warning in the Preface section.

1. Disconnect the battery ground cable from the battery. Refer to Battery Negative Cable Disconnection and Connection.
2. Remove the engine cover. Refer to Engine Cover Replacement.



3. Disconnect the spark plug wires (1) from the ignition coils.



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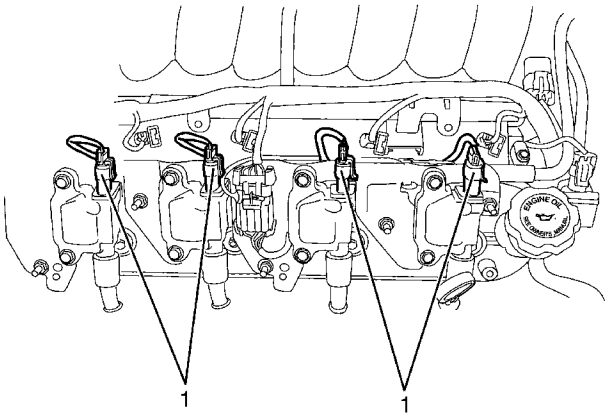
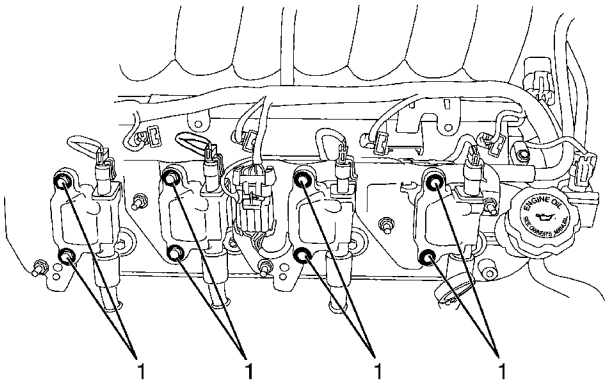
4. Disconnect the main ignition coil harness connector (1) from the ignition coil assembly.
5. Remove the ignition coil assembly to rocker cover retaining bolts (2).

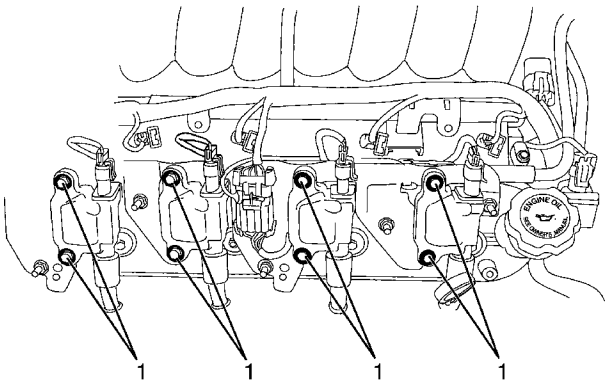


6. Remove the ignition coil assembly from the engine.
7. Disconnect the ignition coil to ignition coil wiring harness connectors (1).



8. Remove the ignition coil to ignition coil assembly retaining bolts (1).
9. Remove the ignition coils from the ignition coil assembly.

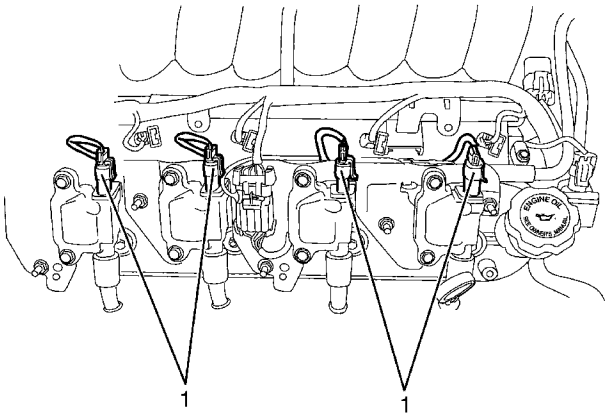
Installation Procedure



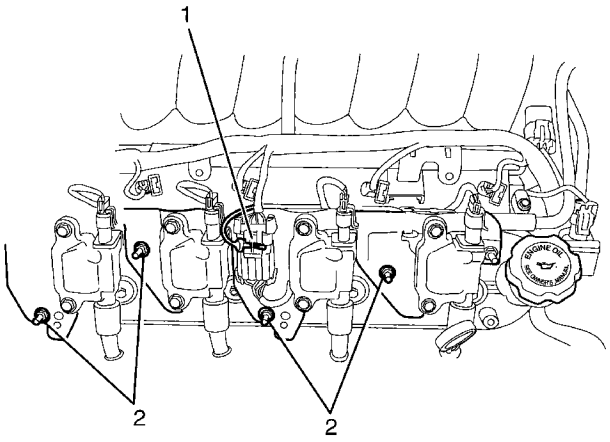
1. Install the ignition coil assembly.

   Caution: Refer to Fastener Caution in the Preface section.

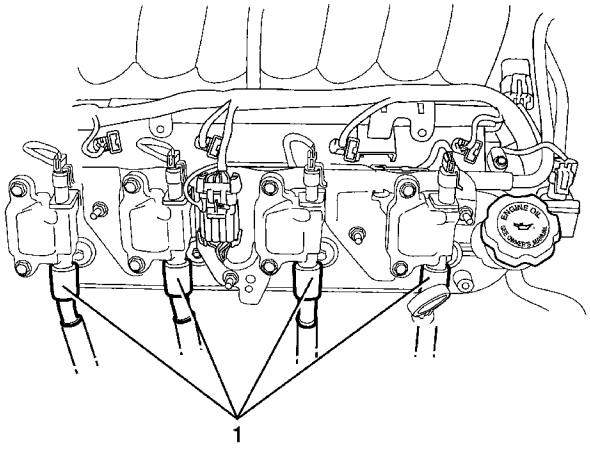
2. Install the ignition coil to ignition coil assembly retaining bolts (1) and tighten to **12 N·m (106 lb in)**.



3. Connect the ignition coil to ignition coil wiring harness connectors (1).
4. Install the ignition coil assembly to the engine.



5. Install the ignition coil assembly to rocker cover retaining bolts (2) and tighten to **12 N·m (106 lb in)**.
6. Connect the main ignition coil harness connector (1) to the ignition coil assembly.



7. Connect the spark plug wires (1) to the ignition coils.
8. Install the engine cover. Refer to Engine Cover Replacement.
9. Connect the battery ground cable to the battery. Refer to Battery Negative Cable Disconnection and Connection.

Spark Plug Wire Inspection

Important: Spark plug wire integrity is vital for proper engine operation. A thorough inspection will be necessary to accurately identify conditions that may affect engine operation. Inspect for the following conditions:

1. Correct routing of the spark plug wires. Incorrect routing may cause cross-firing.
2. Inspect for any signs of cracks or splits in the wires.
3. Inspect each boot for the following conditions:
   - Tearing
   - Piercing
   - Arcing
   - Carbon tracking
   - Corroded terminals
4. If corrosion, carbon tracking or arcing are indicated on a spark plug wire boot or on a terminal, replace the wire and the component connected to the wire.

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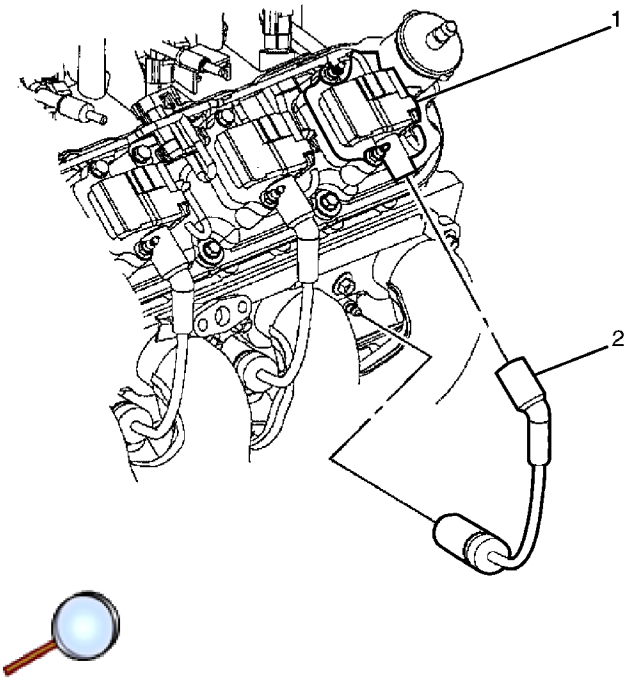
Spark Plug Wire Replacement

Removal Procedure

1. Remove the engine cover. Refer to Engine Cover Replacement .



2. Disconnect the spark plug wire (2) to the spark plug.
   - Twist each spark plug boot 1/2 turn.
   - Pull only on the boot in order to remove the wire from each spark plug.
3. Disconnect the spark plug wire from the ignition coil (1).
   - Twist each spark plug boot 1/2 turn.
   - Pull only on the boot in order to remove the wire from the ignition coil.

Installation Procedure

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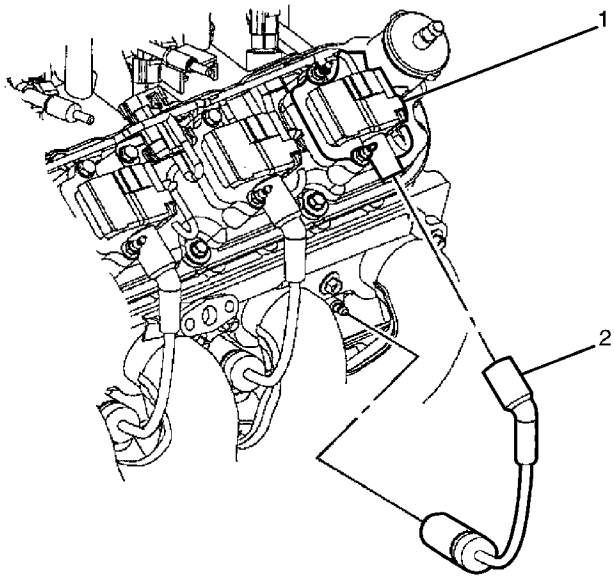
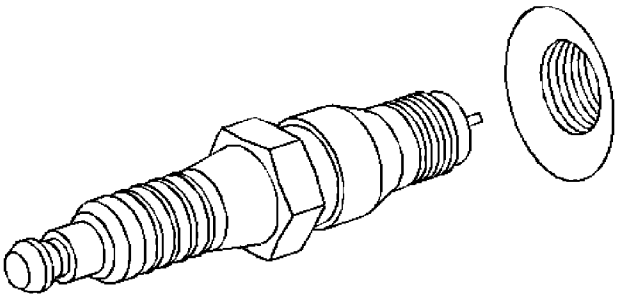


1. Install the spark plug wire to the ignition coil (1).
2. Install the spark plug wire (2) to the spark plug.
3. Inspect the spark plug wire for proper installation:
   - Push sideways on each spark plug boot in order to inspect the seating.
   - Reinstall any loose spark plug boot.
4. Install the engine cover. Refer to Engine Cover Replacement .

Spark Plug Replacement

Removal Procedure

1. Remove the engine cover. Refer to Engine Cover Replacement.
2. Remove the spark plug wires. Refer to Spark Plug Wire Replacement.



3. Loosen each spark plug 1 or 2 turns.
4. Use a brush, or use compressed air in order to remove any dirt from the spark plugs.
5. Remove the spark plugs one at a time and place each plug in a tray marked with the corresponding cylinder numbers.

Installation Procedure

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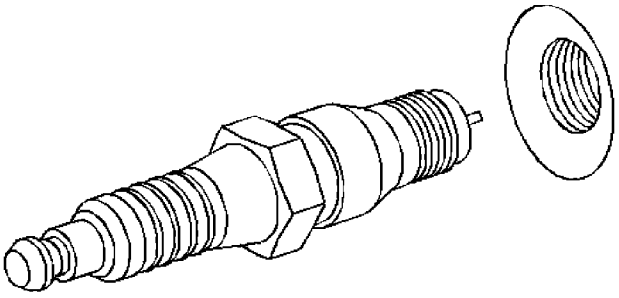


1. Inspect each spark plug gap. Adjust each plug as needed.

   Specification
   Spark plug gap: 1.524 mm (0.060 in).

2. Hand start the spark plugs in the corresponding cylinders.

   Caution: Refer to Fastener Caution in the Preface section.

3. Tighten the spark plugs. Tighten the engine spark plug on a NEW cylinder head to **20 N·m (15 lb ft)** and the engine spark plug on subsequent installations to **15 N·m (11 lb ft)**.
4. Install the spark plug wires. Refer to Spark Plug Wire Replacement.
5. Install the engine cover. Refer to Engine Cover Replacement.

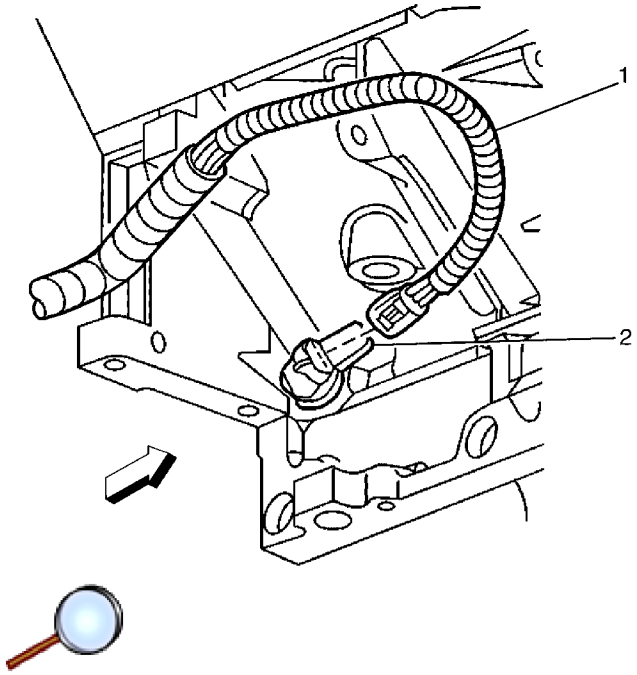
Crankshaft Position Sensor Replacement

Removal Procedure

Warning: Refer to Protective Goggles and Glove Warning in the Preface section.

Danger: To avoid any vehicle damage, serious personal injury or death when major components are removed from the vehicle and the vehicle is supported by a hoist, support the vehicle with jack stands at the opposite end from which the components are being removed and strap the vehicle to the hoist.

1. Disconnect the battery ground cable from the battery. Refer to Battery Negative Cable Disconnection and Connection.
2. Raise and support the vehicle. Refer to Lifting and Jacking the Vehicle.
3. Remove the starter. Refer to Starter Motor Replacement.



4. Disconnect the crankshaft position (CKP) sensor electrical connector (2) from the wiring harness (1).

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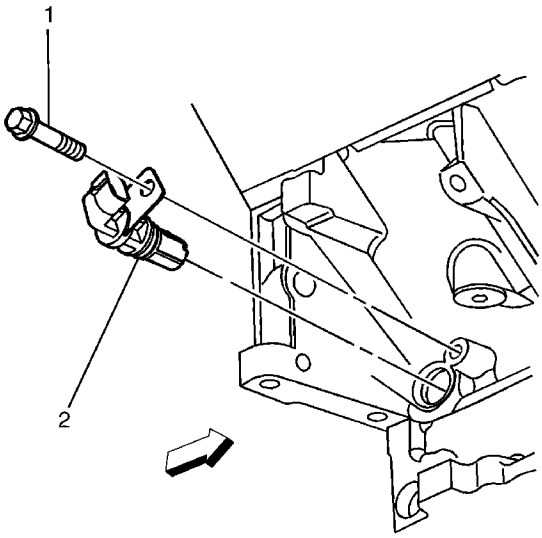
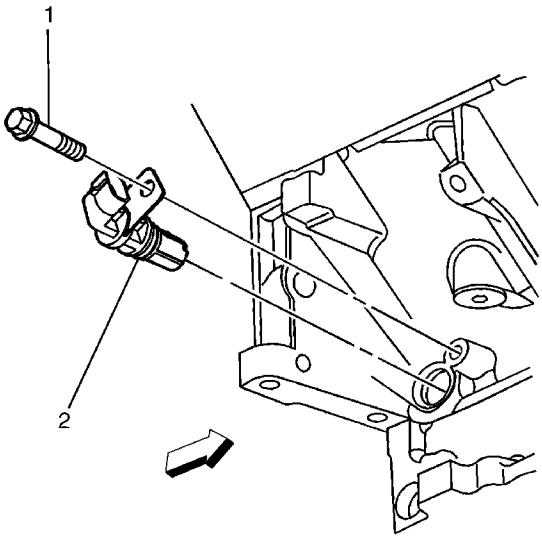


5. Remove the CKP sensor to engine block retaining bolt (1).
6. Remove the CKP sensor (2) from the engine block.

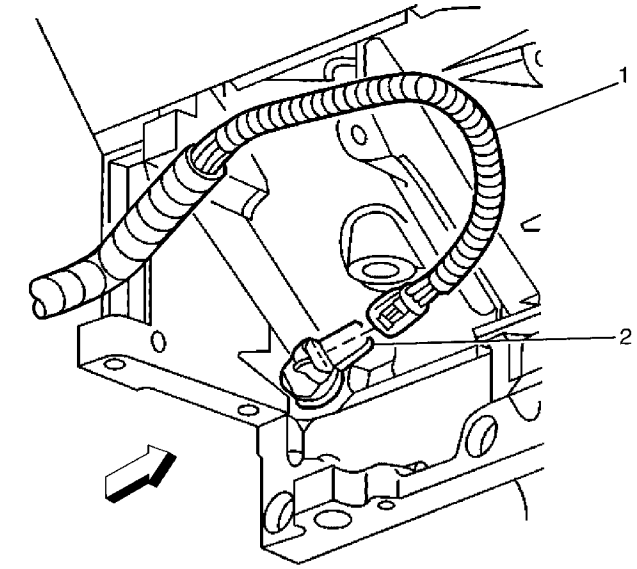
Installation Procedure



1. Install the CKP sensor (2) to the engine block.

   Caution: Refer to Fastener Caution in the Preface section.

2. Install the CKP sensor to engine block retaining bolt (1) and tighten to **25 N·m (18 lb ft)**.



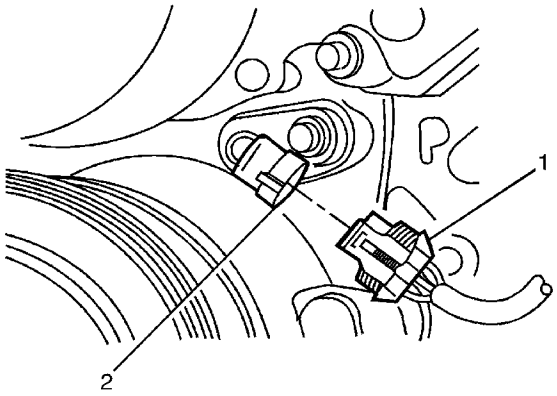
3. Connect the CKP sensor electrical connector (2) to the wiring harness (1).
4. Install the starter. Refer to Starter Motor Replacement.
5. Lower the vehicle.
6. Connect the battery ground cable to the battery. Refer to Battery Negative Cable Disconnection and Connection.
7. If re-programming is required. Refer to Control Module References.

Camshaft Position Sensor Replacement

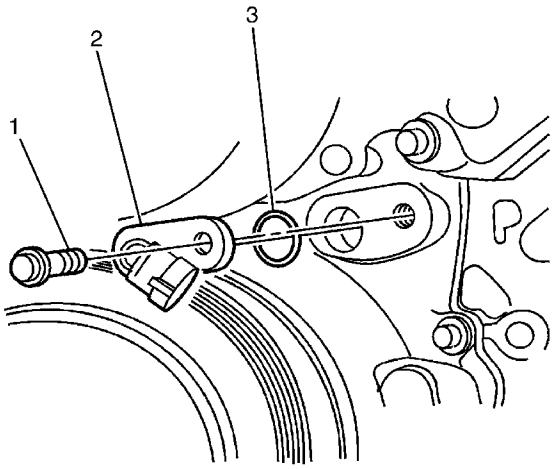
Removal Procedure

Warning: Refer to Battery Disconnect Warning in the Preface section.

1. Disconnect the battery ground cable from the battery. Refer to Battery Negative Cable Disconnection and Connection.
2. Remove the engine cover. Refer to Engine Cover Replacement.



3. Disconnect the camshaft position (CMP) sensor electrical connector (1).



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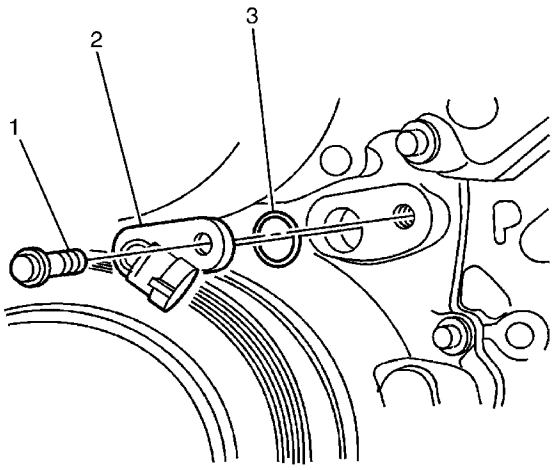
4. Remove the CMP sensor to engine front cover retaining bolt (1).
5. Remove the CMP sensor (2) from the engine front cover.
6. Remove the CMP sensor O-ring (3) from the CMP sensor and discard.

Discard the O-ring.

Installation Procedure



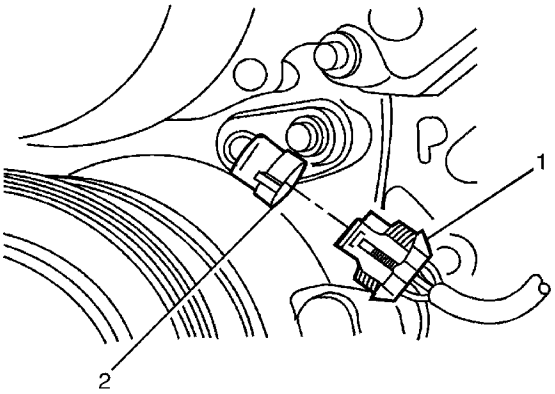
Note: Install a NEW O-ring to the camshaft sensor

Note: Before installing the camshaft sensor, apply a small amount of clean motor oil to the O-ring (3).

1. Install a NEW O-ring (3) to the CMP sensor.
2. Install the CMP sensor (2) to the engine front cover.

Caution: Refer to Fastener Caution in the Preface section.

3. Install the CMP sensor to engine front cover retaining bolt (1) and tighten to **25 N·m (18 lb ft)**.



4. Connect the CMP sensor electrical connector (1) to wiring harness.
5. Install the engine cover. Refer to Engine Cover Replacement.
6. Connect the battery ground cable to the battery. Refer to Battery Negative Cable Disconnection and Connection.
7. If re-programming is required, refer to Control Module References.

Knock Sensor Replacement (Right Bank)

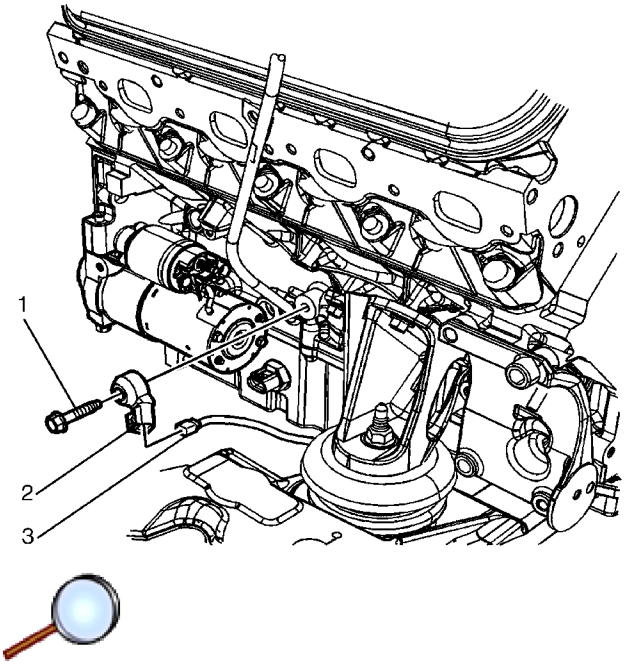
Removal Procedure

Warning: Refer to Protective Goggles and Glove Warning in the Preface section.

Warning: Refer to Battery Disconnect Warning in the Preface section.

Danger: To avoid any vehicle damage, serious personal injury or death when major components are removed from the vehicle and the vehicle is supported by a hoist, support the vehicle with jack stands at the opposite end from which the components are being removed and strap the vehicle to the hoist.

1. Disconnect the battery ground cable from the battery. Refer to Battery Negative Cable Disconnection and Connection.
2. Raise and support the vehicle. Refer to Lifting and Jacking the Vehicle.
3. Remove the starter motor. Refer to Starter Motor Replacement.



4. Disconnect the engine wiring harness (3) from the knock sensor (2).
5. Remove the knock sensor to engine block retaining bolt (1).
6. Remove the knock sensor (2) from the engine block.

Installation Procedure

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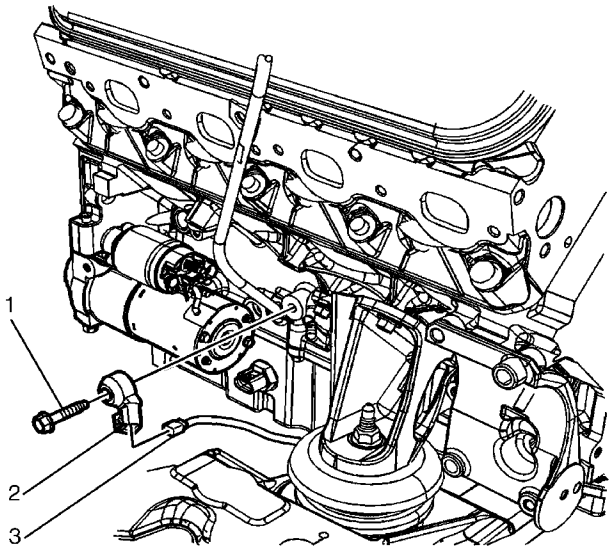


1. Connect the engine wiring harness (3) to the knock sensor (2).
2. Position the knock sensor (2) on the engine block.

Caution: Refer to Fastener Caution in the Preface section.

3. Install the knock sensor to engine block retaining bolt (1) and tighten to **20 N·m (15 lb ft)**.
4. Install the starter motor. Refer to Starter Motor Replacement.
5. Connect the battery ground cable to the battery. Refer to Battery Negative Cable Disconnection and Connection.

Knock Sensor Replacement (Left Bank)

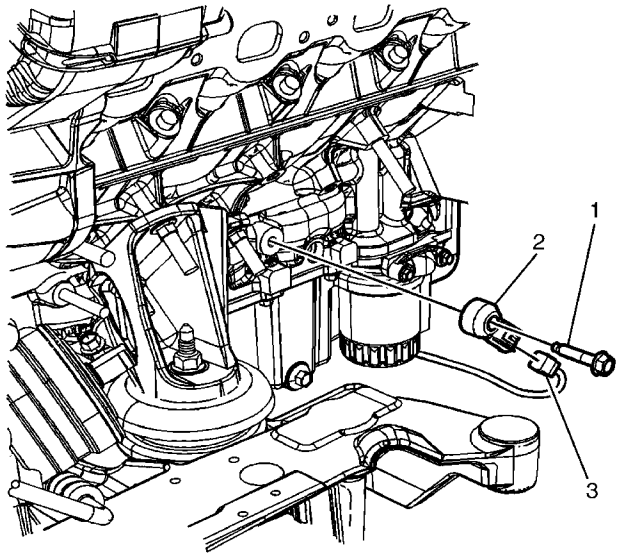
Removal Procedure

Warning: Refer to Protective Goggles and Glove Warning in the Preface section.

Warning: Refer to Battery Disconnect Warning in the Preface section.

Danger: To avoid any vehicle damage, serious personal injury or death when major components are removed from the vehicle and the vehicle is supported by a hoist, support the vehicle with jack stands at the opposite end from which the components are being removed and strap the vehicle to the hoist.

1. Disconnect the battery ground cable from the battery. Refer to Battery Negative Cable Disconnection and Connection.
2. Raise and support the vehicle. Refer to Lifting and Jacking the Vehicle.



3. Disconnect the engine wiring harness (3) from the knock sensor (2).
4. Remove the knock sensor to engine block retaining bolt (1).
5. Remove the knock sensor (2) from the engine block.

Installation Procedure

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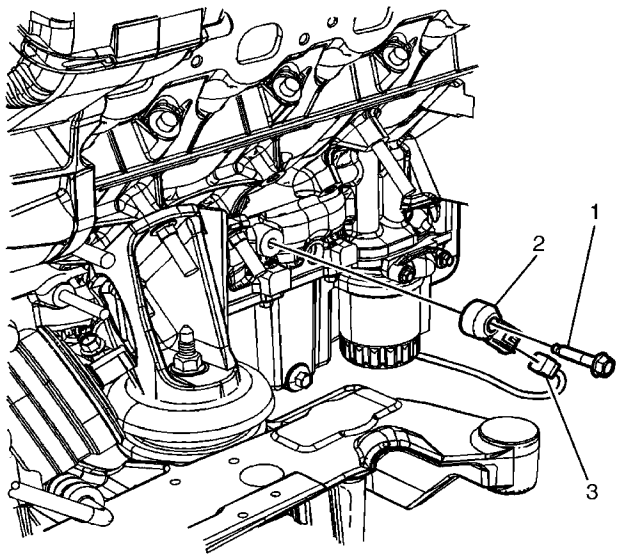


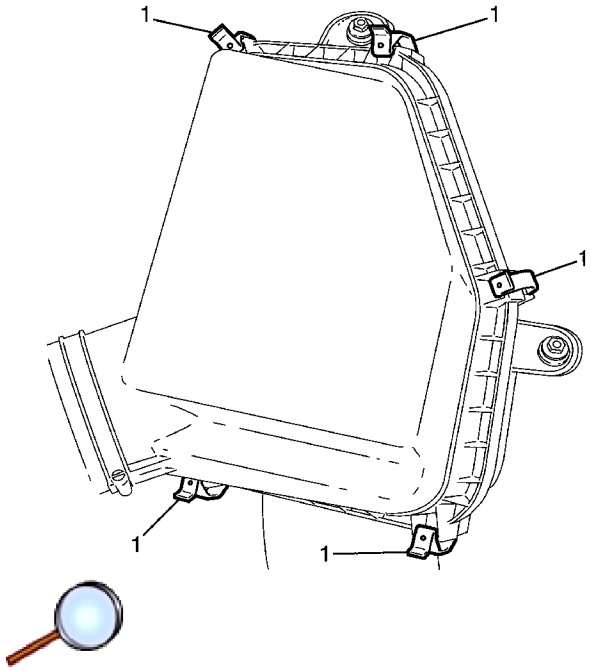
1. Connect the engine wiring harness (3) to the knock sensor (2).
2. Position the knock sensor (2) on the engine block.

Caution: Refer to Fastener Caution in the Preface section.

3. Install the knock sensor to engine block retaining bolt (1) and tighten to **20 N·m (15 lb ft)**.
4. Connect the battery ground cable to the battery. Refer to Battery Negative Cable Disconnection and Connection.

Air Cleaner Element Replacement

Removal Procedure



1. Remove five retaining clips (1) securing the upper air cleaner body.
2. Remove upper air cleaner body and air cleaner filter assembly.
3. Remove the air cleaner element from the air cleaner assembly.

   Discard the air cleaner element.

Installation Procedure

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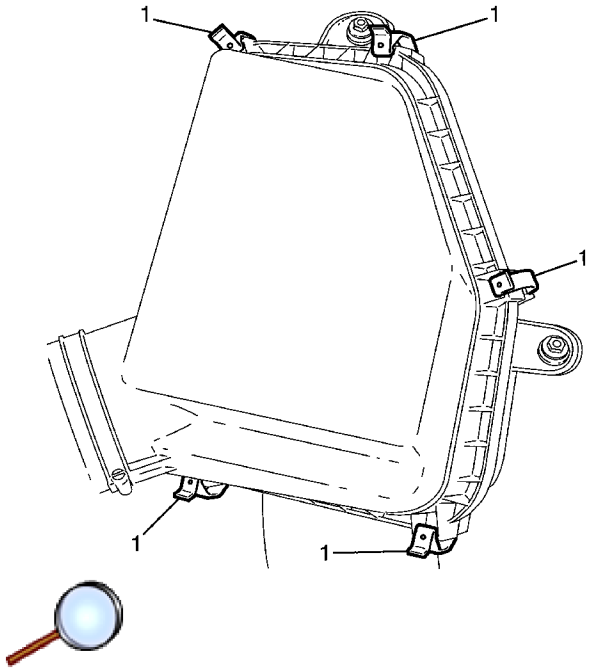
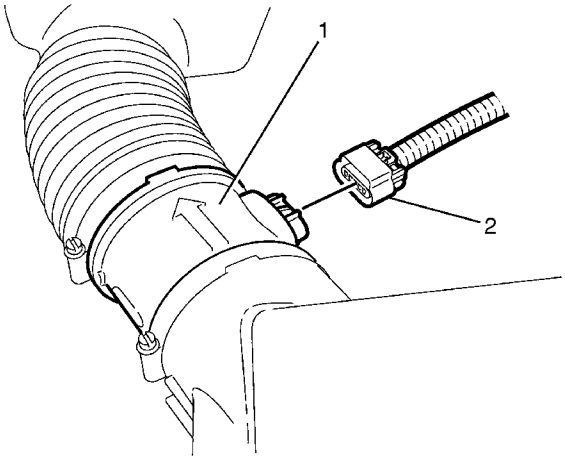


1. Install a NEW air cleaner element to the lower air cleaner body.
2. Reassemble the air cleaner element into the upper air cleaner body and place the upper air cleaner body onto the lower air cleaner body.
3. Reinstall the five retaining clips (1) securing the upper air cleaner body to the lower air cleaner body.

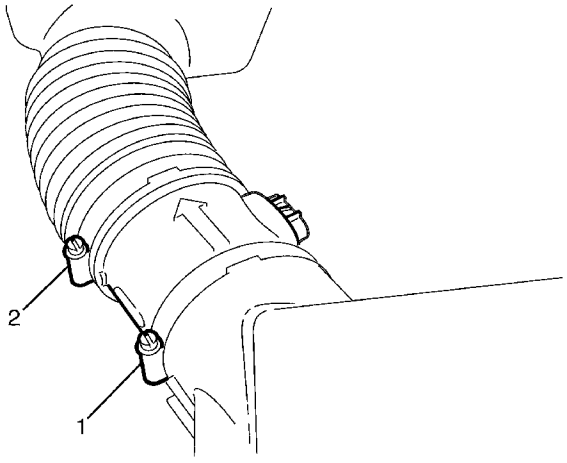
Air Cleaner Assembly Replacement

Removal Procedure

1. Remove the engine cover. Refer to Engine Cover Replacement.



2. Disconnect the wiring harness connector (2) to the intake air temperature (IAT)/mass air flow (MAF) sensor (1).



3. Loosen the IAT/MAF to upper air cleaner body retaining clamp (1).
4. Loosen the IAT/MAF to air intake duct retaining clamp (2).

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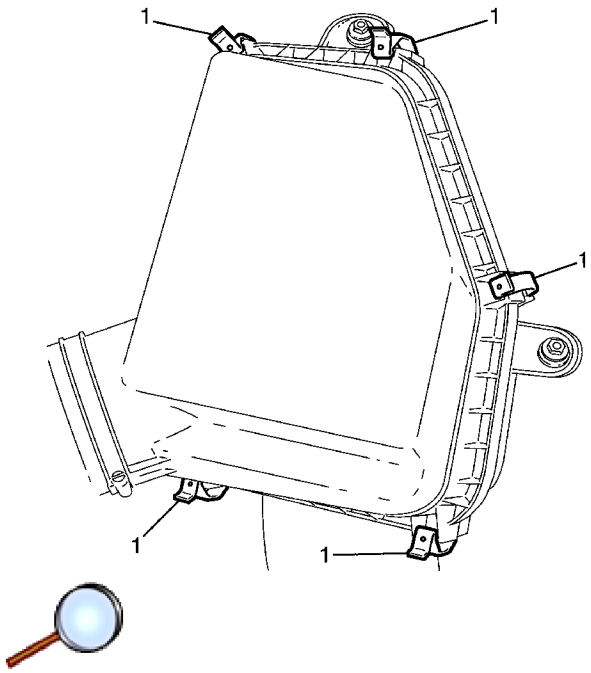
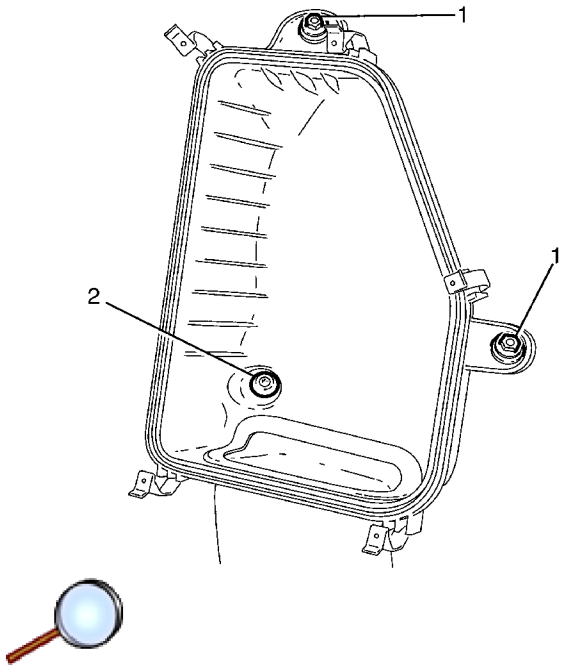
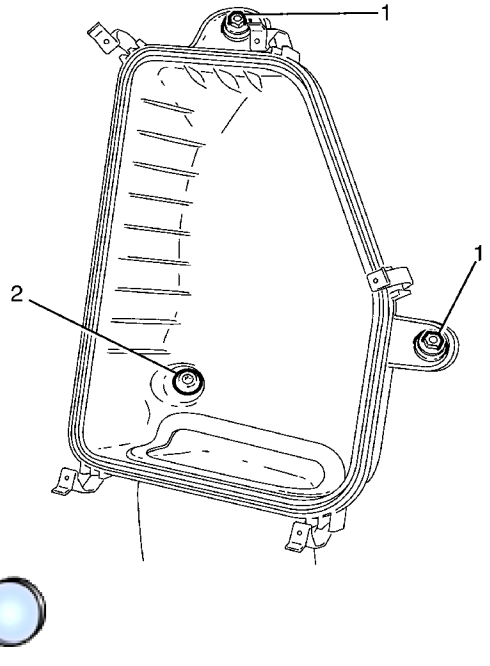


5. Remove five retaining clips (1) securing the upper air cleaner body.
6. Remove upper air cleaner body and air cleaner filter assembly.
7. Remove the air cleaner element. Refer to Air Cleaner Element Replacement.



8. Remove the lower air cleaner body to front inner wheelhouse retaining nuts (1).
9. Disengage the lower air cleaner body to front inner wheelhouse retainer (2).
10. Remove the lower air cleaner body from the vehicle.

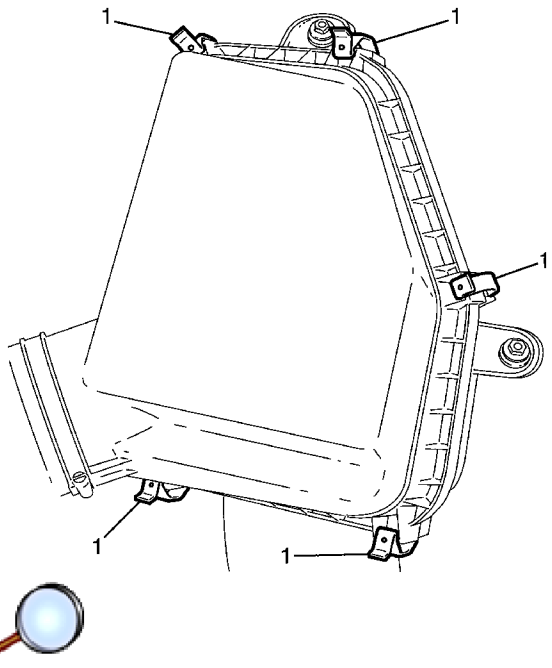
Installation Procedure



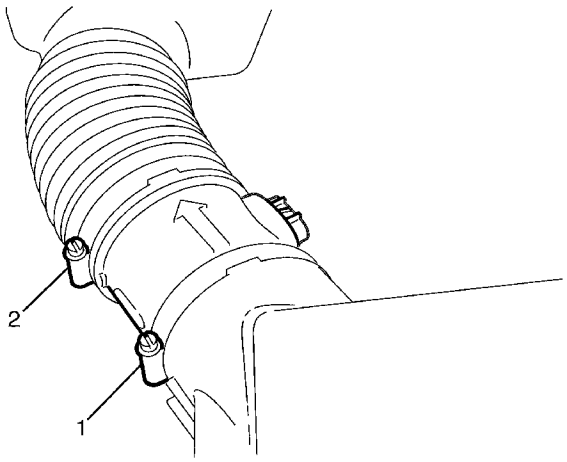
1. Install the lower air cleaner body to the front inner wheelhouse.
2. Engage the lower air cleaner body to the front inner wheelhouse retainer (2).

Caution: Refer to Fastener Caution in the Preface section.

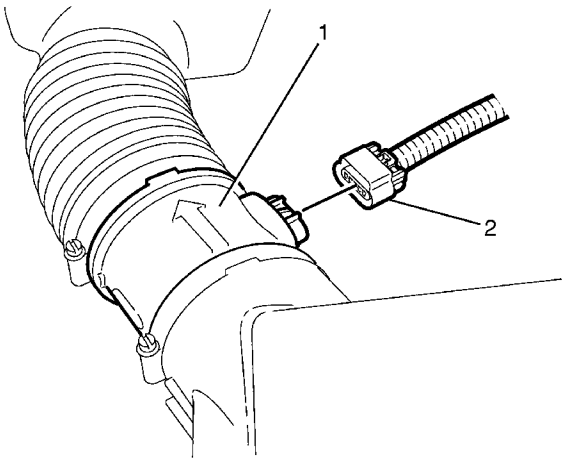
3. Install the lower air cleaner body to front inner wheelhouse retaining nuts (1) and tighten to **10 N·m (89 lb in)**.
4. Install the air cleaner element to the lower air cleaner body. Refer to Air Cleaner Element Replacement.



5. Assemble the air cleaner element into the upper air cleaner body and place the upper body onto the lower air cleaner body.
6. Install the 5 retaining clips (1) securing the upper air cleaner body to the lower air cleaner body.



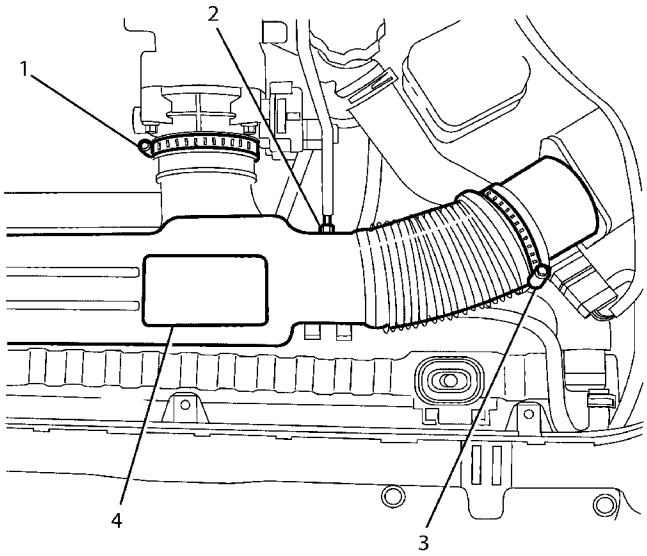
7. Install the IAT/ MAF sensor to the upper air cleaner body.
8. Install the IAT/MAF sensor to the air intake duct.
9. Install the IAT/MAF sensor to upper air cleaner body retaining clamp (1) and tighten to **2 N·m (18 lb in)**.
10. Tighten the IAT/MAF sensor to air intake duct retaining clamp (2) to **2 N·m (18 lb in)**.



11. Connect wiring harness connector (2) to the IAT/ MAF sensor (1).
12. Install the engine cover. Refer to Engine Cover Replacement.

Air Cleaner Inlet Duct Replacement

Removal Procedure



1. Remove the positive crankcase ventilation (PCV) hose (2) from the air cleaner duct resonator (4).
2. Remove the air cleaner duct to throttle body retaining clamp (1).
3. Remove the air cleaner duct to intake air temperature (IAT)/mass air flow (MAF) sensor retaining clamp (3).
4. Remove the air cleaner duct (4).

Installation Procedure

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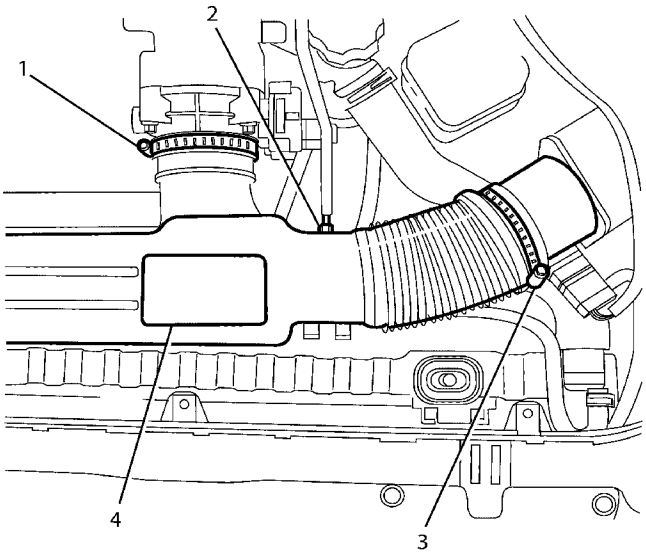

1. Install the air cleaner intake duct (4) to the engine.

   Caution: Refer to Fastener Caution in the Preface section.

2. Install the air cleaner duct to throttle body retaining clamp (1) and tighten to **4 N·m (35 lb in)**.
3. Install the air cleaner duct to IAT/MAF retaining clamp (3) and tighten to **4 N·m (35 lb in)**.
4. Install the PCV hose (2) to the intake duct resonator.